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# ***JPRS Report***

## **Science & Technology**

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***USSR: Chemistry***

# Science & Technology

## USSR: Chemistry

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**Gas Flows Studied With Laser Doppler Speed Meter**

18410242c Moscow VECHERNYAYA MOSKVA in Russian 5 Feb 88 p 2

[Text] Research of hydrodynamics of swirled gas flows is being conducted with the aid of a laser doppler speed meter in the scientific research laboratory of the chair "Chemical Engineering Processes and Equipment" at the Moscow Institute of Chemical Machine Building.

[The photograph shows Candidate of Technical Sciences A. Zhikharev and V. Kazakov, a junior science associate, working with a laser unit.]

/9738

**Use of "Milikhrom" Microcolumn Chromatography for Determining Metal Chelates**

18410136b Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 42, No 10, Oct 87 (manuscript received 10 Jul 86) pp 1773-1777

[Article by A.Yu. Malykhin, T.A. Bolshova, S.N. Lanin, and Yu.S. Nikitin, Moscow State University imeni M.V. Lomonosov]

[Abstract] High Performance Liquid Chromatography (HPLC) is being used with increasing frequency in inorganic chemistry. Interest in this method for separating and determining trace amounts of metals in domestic practice may increase after the appearance of the "Milikhrom" microcolumn chromatograph, which has several technical advantages over foreign analogues. This chromatograph is recommended for biochemical, pharmaceutical, and other analyses of complex organic compounds. It is not suitable for inorganic analysis, since its utilities and sorbent can not be used with aggressive media. For this reason, it is promising to determine the metals as chelates, which are similar to organic compounds and do not require rigorous separation conditions. Therefore, a study was conducted on the use of the "Milikhrom" microcolumn chromatograph to separate and determine hydroxyquinolates of copper (II), aluminum, and gallium in normal phase HPLC. The column contained 5  $\mu$ m silica, and the eluate was 9:1 chloroform:isopropanol. Excess 8-hydroxyquinoline reagent was removed by washing with 0.1 M sodium hydroxide. Detection at 254 nm was suitable. Stopped-flow scans were also used to confirm peak identity. With this system, the aluminum or gallium chelate could be resolved from the copper chelate, but the first two could not be separated from one another. It is estimated that 14,400 theoretical plates are needed to resolve the aluminum chelate from the gallium. Peak height was linearly related to metal concentration from 0.01 to 5  $\mu$ g/ml. The aluminum chelate had the greatest response factor and the copper the lowest. Deviations observed in

the results of analyzing a model water sample are due to problems with chelate synthesis, not chromatographic performance. Analysis time was less than 4 minutes. The results indicate that the "Milikhrom" microcolumn chromatograph is suitable for inorganic analysis, achieving rapid and simple separation and identification of trace metals as chelates. Figures 3; references 32: 15 Russian, 17 Western.

12126

**Oscillating Chemical Reactions and Their Meaning for Analytical Chemistry**

18410136a Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 42, No 10, Oct 87 (manuscript received 13 Nov 86) pp 1743-1752

[Article by K.B. Yatsimirskiy, Institute of Physical Chemistry imeni L. V. Pisarzhevskiy, UkSSR Academy of Sciences, Kiev]

[Abstract] A review of oscillating chemical reactions and their possible future uses in analytical chemistry is presented. Many reactions involving the oxidation of various substrates by bromate, catalyzed by transition metals, including the earliest oscillators discovered, exhibit periodicity. These reactions have been studied in the greatest detail. In the 1950s, periodicity was discovered in the disproportionation of hydrogen peroxide catalyzed by iodate-iodine vapors, biological glycolysis, and chlorite oscillators. The mechanisms of these reactions are complex, involving many simultaneous processes. The reactions are designated bistable, with oscillations arising in the transition from one steady state to another. The mathematical description of oscillating processes involves the solution of nonlinear differential equations. Solution of these equations indicates that the reactions can proceed either by normal or oscillating pathways, depending on kinetic parameters, in particular, on initial reagent concentrations and rate constants. While most oscillating reactions discovered to date have been observed spectrophotometrically or electrochemically, discovery of new oscillators using thermochemistry, chemiluminescence, acoustics, EPR, manometry, etc., is an important task of contemporary analytical chemistry. Regular and chaotic oscillators, as well as self-extinguishing ones, have been discovered. Transitions between types are possible. A mathematical expression which permits global analysis of these systems involves system dimensions, the type of nonlinearity, the number and stability of solutions, bifurcation, limiting cycles, and singular points. Systems can be described by phase plane diagrams. Oscillations arise when reagents react with intermediates by autocatalysis or autoinhibition with feedback control. The first use of oscillating reactions in analytical chemistry involved sharp transitions from smooth to oscillating pathways and from one

regime to another. The secondary catalytic effect may be used to determine small amounts of certain metallic compounds, such as ruthenium and vanadium. Inhibitory effects may be used to measure molecular oxygen, copper (II), chlorine, iodine, alcohol, p-benzoquinone, etc. While spatial oscillators are also promising for

analytical chemistry, no reports of their use have been published to date. Figures 3; references 32: 15 Russian, 17 Western.

12126

**Magnetic Field Effects on Chemical Reactions**  
18410244a Moscow TASS in Russian 1327 GMT 24  
Feb 88

[Text] Soviet chemists propose to use magnetic fields rather than expensive catalysts to obtain various synthetic materials. Experiments conducted at the Institute of Chemical Physics of the USSR Academy of Sciences have shown that it is possible to stop, accelerate, and change the direction of practically any chemical reaction with the aid of even a weak magnetic field with an intensity of between 10 and 100 Oe. Specialists believe that the problem involves determining at which point in the reaction to use them.

Using a magnetic field, scientists have helped industry to double the production of certain plastics, using the same amount of raw material, i.e., petroleum products. It is known that with the aid of chemical processes, plastics, synthetic materials, and liquid polymers are produced.

In an interview with the TASS correspondent, Doctor of Physics and Mathematics Yevgeniy Frankevich said that hitherto in controlling chemical reactions, there has been widespread use of catalysts, high and low temperatures, and various pressures, which require a great material expenditure.

For research purposes, scientists chose the most varied base compounds—liquids and solids. As a result, it was possible fundamentally to expand the range of synthetic materials used in modern technology, electronics, medicine, engineering, construction, and agriculture.

/9738

**Effectiveness of Formation of Singlet Oxygen,  
Photosensitized by Water-Soluble Porphyrins**  
18400096a Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian No 5, Sep 87 (manuscript received  
27 Mar 86) pp 2455-2460

[Article by B.M. Dzhagarov, K.I. Salokhiddinov, G.D. Yegorova, and G.P. Gurinovich, Institute of Physics, BSSR Academy of Sciences, Minsk]

[Abstract] Recent studies of photophysical and oxidation-reduction properties of water-soluble porphyrins have been prompted by the feasibility of using metalloporphyrins in a photochemical apparatus for isolating  $H_2$  from water and porphyrin free bases as drugs for use in phototherapy of some kinds of cancer. A comparison of the capacity of a water-soluble porphyrin free base and its complexes with Zn(II) and Pd(II) for photosensitizing singlet oxygen was described and discussed. Results of studies for water-soluble porphyrins were compared with similar data for their closest analogs in toluene solutions. The relative quantum yield of photosensitized formation of singlet oxygen was determined by the quantum yield of intercombined conversion in the sensitizer molecules, porphyrins. Supplementary experimental data showed that the quantum yield of sensitized singlet oxygen formation equals, within the error limits of the experiment, a quantum yield of  $\gamma_T$ . References 24: 10 Russian; 14 Western.

02791

**Chemical Industry Head Interviewed on Work Acceleration**

18410254 Moscow SOTSIALISTICHESKAYA  
INDUSTRIYA in Russian 23 Mar 88 pp 1-2

[Interview with V. Afonin, head of the Chemical Industry Department of the CPSU Central Committee, by N. Goncharov, SOTSIALISTICHESKAYA INDUSTRIYA special correspondent: "Chemistry and Acceleration;" date and place not given; first paragraph is SOTSIALISTICHESKAYA INDUSTRIYA introduction]

[Text] The "Comprehensive Program for chemicalization of the USSR National Economy in the Period up to the Year 2000" was adopted in 1985. V. Afonin, head of the Chemical Industry Department of the CPSU Central Committee, and N. Goncharov, our special correspondent, today discuss the way in which it is being fulfilled and the progress in restructuring in the sectors of the chemical industry.

[Question] What are the priority directions of the Program, Veniamin Georgiyevich?

[Answer] First, one general opinion. The chemical industry, with its varied, sometimes completely dissimilar production, can least of all be called a separate sector of industry in the ordinary sense. Within the structure of several ministries with chemistry specialization, we have a great many enterprises and scientific-research subdivisions closely interacting in an overall technological network. The entirety of this collaboration of production facilities, tied by thousands of threads with the entire national economy, is usually called the country's chemical complex.

As for priority directions, they are the production of synthetic resins, plastics, filaments and fibers, efficient mineral fertilizers, preservatives, pesticides, products of deep petroleum refining, and the output of new dyes and various chemical additives and reagents. The special attention paid to these "branches" of the Comprehensive Program for chemicalization of the USSR National Economy fully corresponds to the world trend in development of the chemical industry. It is here precisely that its own type of rapid breakthroughs have taken place in the last few decades. It has become possible to successfully substitute for expensive natural materials, to simplify technology, and to increase the quality of items, the harvest of agricultural crops, and the yield from livestock breeding. In the total of factors determining the harvest yield, some 50-60 percent of all their additives are chemicalization agents. One ruble spent for feed phosphates in livestock breeding gives an additional 7-10 rubles worth of product. The use of plastics in machine building, electrical equipment, agriculture, construction, everyday life, etc., is tremendously advantageous. The effect from using plastic pipes is high. At motor vehicle

plants, one ton of polymer materials can replace three-four tons of metal and greatly reduce the energy-intensiveness and labor input. Chemistry also guards health: it is an extremely important producer of medications.

[Question] Just how are we making use of its lavish gifts?

[Answer] Frankly speaking, so far, not so well: on the whole, worse than in the highly developed countries, despite the fact that there are good results in some directions. Poor use is made of plastics in motor vehicle construction. So far, our machine builders plan to take seven years to bring their use up to 110 kilograms per passenger vehicle. The United States reached this indicator as far back as 1985. What is keeping us from making a similar surge? Among other reasons—the shortage of polymer materials. We are still producing few synthetic resins and plastics... We are particularly lagging behind in the output of advanced polymers. After all, the Comprehensive Program for Chemicalization specified considerable development of the industry of new building materials for engineering-technical purposes, including composite materials, as well as non-combustible plastics, decorative-finishing items and heat-resistant varnishes. The Ministry of the Chemical Industry was recently criticized by the CPSU Central Committee for failure in these assignments.

It must be said, however, that we have succeeded in developing large enterprises for the output of polymers. The Novopolotsk "Polimer" Production Association can rightfully be regarded as an example of one. The Zima Chemical Plant presents a completely different picture. It is also among the new plants, but the procedures there, let us speak bluntly, are still old: no new capacities have been developed for years, there is little change in interactions with related enterprises, and technological discipline is poor. These unique "chiaroscuro" facilities provide, in my opinion, a graphic example of the quite variegated picture and difficulties in reorganizing the polymer industry.

There are changes for the better in the chemical fiber industry. It has begun to produce more of the most advanced items. New plants have been constructed in Siberia and Belorussia, and the existing production facilities have been considerably expanded. At the present time, over 80 percent of the chemical fibers are used in the production of consumer goods. Some 24 percent of cotton fabrics are produced by using synthetic fiber. At the same time, light industry is continuing to experience a critical shortage of chemical fibers and filaments of the necessary assortment and quality. Because of the shortage of synthetic materials, up to 300,000 tons of cotton fiber a year are used for industrial needs.

[Question] What can be said about our fertilizer industry?



[Answer] Chemists are taking an active part in carrying out the Food Program. Today the Soviet Union is the world leader in fertilizer production. Almost all mineral fertilizers are produced in granular and noncaking forms. Their nutrient content has increased. The production of phosphorus fertilizers is developing at accelerated rates on the basis of the unique Kara-Tau deposit in Kazakhstan. A powerful potassium industry has been created in the Belorussian SSR. Agriculture's need for mineral fertilizers, pesticides and feed additives is far from being fully satisfied, however. At many plants, the quality of these products leaves much to be desired. Almost a third of the field crop areas in the country are not receiving "supplementary feeding."

[Question] Veniamin Georgiyevich! We know that the flow of transport means requiring a tremendous amount of fuel is growing yearly. Meanwhile, the oil field workers do not, it seems, promise any considerable increase in extraction in the near future. The consumption of tires and industrial rubber items is also increasing. How will the enterprises of the USSR Ministry of the Petroleum and Petrochemical Industry respond to this situation?

[Answer] First of all—with further intensification of petroleum processing. Aside from the utmost fuel conservation, this is the only possible way to increase supplies of gasoline and lubricants, and in addition—of electrode coke for nonferrous metallurgy and raw material for the chemical and microbiological industries. After all, intensifying petroleum processing by just one percent gives the national economy a gain of about 250 million rubles a year. This is well known in the sector, and therefore they are striving to erect 17 more complexes which will directly intensify the use of petroleum raw material. Existing units and production facilities are being modernized. Unfortunately, even here not everything is happening as quickly as could be wished....

An increase in the output of petrochemicals is closely connected with the processing of hydrocarbon raw material. Expanding the assortment of rubber with properties assigned in advance, for example, will make possible a considerable rise in the quality of industrial rubber items and conveyor belts, thus substantially increasing the service life of machines. This is particularly important right now. After all, in the motor vehicle of the 1920s there were only 15 rubber parts, but in the modern KamAZ there are over 1000 of them.

The workers in the tire industry are also very busy. Here too, the main thing is to increase the reliability of the items. Unfortunately, there are still too many criticisms of the short life of the tires. In this subsector, however, we have exemplary enterprises—let us mention the "Omskshina" Association, where P.V. Buderkin, Hero of Socialist Labor, is general director. The tires manufactured there sell, as they say, like hotcakes, which cannot be said, for example, of the output of the analogous Chimkent Association. The secret here is simple: the Omsk tires for the ZIL and KamAZ vehicles last

106,000 kilometers, and the same items from the Chimkent plant have a life of less than 21,000 kilometers. At the same time, the equipment and technology at "Chimkent Tire" is considerably better than at Omsk. This means that everything depends on the people, on their degree of organization and discipline, and on their striving to preserve the plant's good name.

Because of poor quality output, an economic "spin" is in its own way sometimes suffered by just those subdivisions of the chemical complex in which personnel skill and production standards are low and where the technology has not been updated for decades. This can be seen particularly graphically in the chemical-photography industry. At the Tasma and Svema Production Associations, for example, the most mass-demand types of movie films are being produced according to obsolete technology created over 20 years ago. What are the directors and Party committees of these enterprises and the USSR Ministry of the Chemical Industry waiting for? The demands on product quality are now growing, as they say, not daily, but hourly. Whoever delays is in great risk of falling by the wayside, and this is simply not the way to do things. For us, State Acceptance of Products is being carried out on an increasingly large scale. Beginning with this January, over 40 percent of the enterprises, producing over 60 percent of the entire output, introduced it in the chemical complex. It is still too soon, of course, to speak of a major turning point, but positive trends have been noted.

It is appropriate to note here, however, that the good intentions and beneficial initiative of chemists are often held back because of the fact that there is not enough good equipment. The machine builders are letting us down. The fixed capital is being updated slowly, and therefore, over one-third of the equipment at chemical plants is obsolete and has been in operation for over 20 years. We are forced to buy a great deal of equipment abroad. The machine builders must restructure their work more decisively. Our uneasiness in connection with the situation that has formed is known to I.S. Silayev, chairman of the Bureau of the USSR Council of Ministers on Machine Building, and to V.M. Lukyanenko, minister of Chemical and Petroleum Machine Building, and we are counting on the most attentive examination of the problems that have arisen and the adoption of urgent measures.

[Question] How is the chemical complex itself restructuring—its ministry, departments, and scientific-research subdivisions? What is new in the management of such an important sector of industry on the governmental level and in the work of the Chemical Industry Department of the CPSU Central Committee?

[Answer] Right now it can be said, quite definitely: restructuring in the country's chemical complex has been noticeably activated, although the urgent problems are not always solved thoroughly and efficiently. Its outmoded stereotypes of economic thinking, departmental

narrowness, constraint, and bureaucracy are taking their toll. The role and functions of the ministries are changing slowly. Promising proposals and solutions sometimes even now have a hard time making their way through the usual stratification of sectorial directions and instructions. There are, however, flashes of fresh, out-of-the-ordinary approaches to solving the complex problems of the economic system. In order to simplify the structure of sectorial management, to better coordinate the activity of the chemical ministries and departments, and to more efficiently direct the chemical industry, the Bureau of the USSR Council of Ministers on the Chemical-Timber Complex has been created. The administrative structures have begun to improve, particularly at the upper unit. This reorganization is being carried out in all the chemical ministries. The number of structural units of the upper management level is being reduced by over half, and the number of workers in them—by 30-40 percent. We are convinced that the main attention of the ministry should now be concentrated on prospective development of the sectors and an advanced scientific-technical and investment policy.

The increasing activity of administrative personnel is already being felt. For example, the promising suggestion of specialists of the USSR Ministry of Mineral Fertilizer Production on creating a new system for managing the investment process on a contractual basis has attracted attention. It is known that we are still building production facilities for chemistry (indeed, not just for chemistry!) at an impermissibly slow rate. In the construction of major facilities, 8-10 years pass from making the decision to putting them into operation. During this time, the designs grow hopelessly obsolete, and we are doomed to lag behind in world technical progress. This happens because the unified process of setting up new production facilities has now been broken up into separate stages, none of the participants in which is materially responsible for the end results. The basis of the proposal of the specialists of the Ministry of Mineral Fertilizer Production is to conclude a single contract on an economic basis to fulfill the State order to set up production capacity between the enterprise-buyer and the rest of the participants in the investment process, i.e., scientific-research and planning institutes, construction and installation organizations, and the local soviets. We see in this undertaking the rudiments of a new economic mechanism, capable of considerably accelerating scientific-technical progress in the sectors of the chemical complex.

It must be said that each sensible idea, each useful intelligent suggestion, finds immediate support from us, the Party workers! Once a month, in the Chemical Industry Department, everybody who has gone out on business trips during this time (and we now go out often) must gather and tell the most interesting information he has learned in the provinces and what particularly upsets the Party workers, managers, specialists, and workers. From a comparison of the many opinions, a general opinion is formed on the change in the structure of the

department. Sectors for economics and improvement of the management mechanism, scientific-technical progress, and future development have now been formed within its structure. Of course, this is within the limits of the existing establishment. Our department, it must be said, has been substantially updated recently. Many experienced workers have arrived from regions where the chemical industry predominates. Among them are gorkom secretaries who head the divisions of Party obkoms. These people are quick on the uptake, experienced, and democratic. While trying not to replace the economists, they evaluate the course of restructuring from the Party standpoint, help local comrades eliminate the "distortions" that have taken shape, rapidly get to know as many people as possible with a grain of useful experience, and actively develop new economic thinking, especially among the "restructuring superintendents."

This is particularly important right now. After all, an ever-increasing number of administrative functions are being passed over to the local sites, directly to the work collectives. Under the conditions of management democratization, it is precisely here that we should seek the main ways to increase the activity of each and every one interested in the end results of the work. Together with the local Party organs, we are trying to implement a systematic approach and outline specific programs of action to increase labor efficiency and the yield created from the labor potential of the chemical industry and to accelerate the solution to social problems. For example, in Georgia, Stavropol Kray, Kuybyshev, Tula, and certain other oblasts, a set of regional measures has been worked out to develop the chemical industry. Proposals for widescale use of hydrocarbon raw material, which so far is not being fully utilized, have been developed in conjunction with the Tyumen Party obkom. This will be a major chemical complex for the production of motor fuel, plastics, synthetic rubbers, and other petrochemical products, including consumer goods. If foreign firms show interest in this program, their participation in creating a unique complex is not ruled out.

The activity of the ministries as a whole must also be kept in sight. Monitoring the implementation of economic reform, organizing enterprise conversion to new conditions of management, and determining priority directions in the development of science and technology are constant concerns of each worker in the division. And then, of course, the most important thing in our activity is organizing the fulfillment of the decrees of the CPSU Central Committee and the USSR Council of Ministers pertaining to the development of the country's chemical complex.

In the last two years of the present Five-Year Plan, the volume of industrial production has increased by 9 percent. One million rubles worth of above-plan goods have been produced. The output of consumer goods has increased by almost one-fourth, and their assortment has expanded considerably.

The qualitative changes outlined in the sector are particularly important. The entire increase in output has been obtained through raising labor productivity. Reduction in the capital-output ratio has slowed. Profit growth rates have outstripped the rates of increase in production volume. Production cost has been reduced more rapidly than in the years of the past Five-Year Plan. The number of unprofitable enterprises has been cut by a factor of 1.5. There are positive changes in the social sphere. In the past period the amount of housing construction increased by 15 percent.

At the same time, some two-year assignments for the 12th Five-Year Plan were unfulfilled. Over one-third of the work collectives failed to cope with contractual commitments, and consumers were undersupplied by about 2 million rubles worth of products. There are still quite a few violations of labor and technological discipline, which leads to a high accident rate and injury, and in some places, capacities are not fully utilized.

[Question] Veniamin Georgiyevich! It can be seen from your account that the workers of the division, as they say, have their fingers on the pulse of restructuring in the chemical complex. No doubt their observations are already making it possible to draw conclusions as to the most characteristic features of the restructuring processes?

[Answer] What we are seeing is in some measure typical of all sectors of industry. This is, in the first place, increasingly open, frank discussions by chemists of all the problems that worry them, and stripping away commanding, strong-willed methods of management. In the second place, it is the evaluation of the difficulties and problems arising from the economic standpoint, which began to show particularly clearly after the Law on the State Enterprise (Association) was put into effect. It would appear that adherents to old management methods do not give up their old habits so easily. The recent disagreement between B.N. Leshchina, general director of the Severodonetsk "Azot" Production Association, and A.O. Kozhevnikov, deputy minister of Mineral Fertilizer Production, is very characteristic of this point of view. When the Association was afforded the opportunity to produce above-plan output, the deputy minister decided to distribute it in the old way, at his own discretion. This type of administration, however, immediately provoked a strong rebuff: this was really the affair of the work collective, where it is more profitable to sell its own commodity. On behalf of the Severodonetsk chemists, their general director decisively rejected the clearly out-moded claims of A.O. Kozhevnikov. Minister N.M. Olshanskiy was in line with the spirit of the times and upheld the position of the Donbass chemists....

[Question] How do you evaluate the experiment of the USSR Ministry of the Petroleum Refining and Petrochemical Industry, all the enterprises of which made the

transition last year to full cost accounting and self-financing? To what extent is it being used now, when the entire chemical industry has begun to work under the new conditions?

[Answer] Our opinion is unanimous: the results of the work of the petroleum refining and petrochemical industry last year speak convincingly of the high effectiveness of the new economic mechanism, of the growing interest of each worker in production economics, and of the great possibilities of increasing labor efficiency. Judge for yourself: for each one-percent increase in production volume in the sector, a four-percent increase in profits was received—twice as much as in the last Five-Year Plan. How was this achieved? Mainly through active introduction of resource-saving equipment and technology, intensification of the people's material interest in the end results, and a decisive departure from "egalitarianism." At the enterprises, planning and contractual discipline is being reinforced, above-norm reserves of physical resources are being noticeably cut, and unprofitable production is being actively revealed.

The "net output" indicator is being used here instead of the commodity indicator to measure labor productivity and wage fund formation. What is its special feature? First of all, the fact that it more fully reflects the conservation of all types of resources, and consequently, its advantage—counter-expensiveness—as well as the fact that it actively stimulates the growth of production efficiency.

In 1987, for the USSR Ministry of Petroleum Refining and the Petrochemical Industry, on the average, each percent of reduction in material input yielded a four-fold greater increase in net output than each percent of increase in production volume. It became possible to give a better reward to work collectives for resource conservation. The reduction of each percent of material input made it possible, with the established norms, to increase the wage fund by 1.7 percent. All of this has a positive effect on the work of the enterprises. Last year, the sector achieved the maximum reduction in material-intensiveness for the last three Five-Year Plans. Also quite important is the fact that the "net output" indicator, aimed at accelerating technical progress, does away with repetitive accounting and more objectively evaluates the actual contribution of the enterprises to creating additional product value.

I also wish to mention this special feature of the economic handwriting of the USSR Ministry of the Petroleum Refining and Petrochemical Industry. At the best of its enterprises, cost accounting has been brought to all the lower subdivisions, shops, brigades, and to each worker. For example, at the Moscow Petroleum Refinery, expenditure norms have been worked out for the shops and brigades, and a calculation of resource use has been organized. Norms have been established for the



collectives for wage charges, depending on the volume of net output, and they themselves distribute the earned funds in consideration of the labor participation of each worker.

The people have felt that they themselves are production bosses. Combined with highly developed self-management and elected appointments of management directors, this has created a situation of general exactingness for the results of each shift and has made possible an improvement in the technical-economic indicators. All agreements for delivering products were fulfilled within the specified period. Their account showed above-plan profit. Labor productivity rose by almost 12 percent, and the average wage—by 8 percent. This is what it means to take up cost accounting in earnest!

On the whole for the sector, however, by no means is everything going smoothly. Here and there, the transition to cost accounting is only in form. It was revealed that some of the directors have a poor concept of the new economic requirements, and many personnel in middle management—shop, shift, and brigade foremen—have proven to be particularly poorly trained. At enterprises where literally everything should have been taken into account, there proved to be no reliable means of accounting and monitoring. The plans were not always balanced with the available capacities and resources. All this, of course, could not help but undermine cost accounting relations. The sector has not succeeded in achieving complete fulfillment of contractual commitments. One fourth of the enterprises have failed to cope with the plans for profit. Despite cost accounting, the ministry had to "feed up" some of their plants from reserve funds....

Not only the first cost accounting joys, but also these "stones on the road" teach something, however. The Chemical Industry Department attentively studied and generalized the experience of the USSR Ministry of the Petroleum Refining and Petrochemical Industry and right away, last year, conducted seminars in Omsk and Bobruysk, where both the successes and the failures of introducing cost accounting were discussed in detail. Moreover, ministry specialists had a detailed discussion with local managers, and the workers of the division gathered together the obkom, gorkom, raykom, and partkom secretaries for a similar frank conversation. There was a common worry—how to eliminate economic illiteracy more rapidly.

It must be assumed that the conclusions from this experiment will be drawn not only in the subdivisions of the chemical complex, but also in the ministries and departments connected with it, especially since, because of the transition to cost accounting of all our sectors, other problems have been sharply exacerbated. The unequal responsibility of related sectors, particularly the USSR Ministry of Power and Electrification and Ministry of Railroads, for the cost accounting damage caused by them alarms many people. What this leads to in

practice can be very clearly seen from last year's ordeals of the "Kuybyshevnefteorgsintez" Association. In the first quarter, through absolutely no fault of its own, it caused the failure of the plan for production of petroleum products. The fact was that the Kuybyshev TETs was in a state of emergency and gave less process steam than was required, and moreover, at a lower temperature. The petroleum refinery workers closed down a number of production facilities and in the first quarter had a 28-million ruble loss. Attempts were made to impose fines on local power engineering workers, and a propitiatory sop was obtained from them—a total of 2 million rubles. They were saved from full compensation due to existing legislation that was convenient for them, in accordance with which they were in no way obligated to make up all the losses due to the short output, only the cost of the power resources. We in the department lodged a complaint against the Association workers, and we think that the necessary corrections should be promptly introduced into the legal interrelations of the parties in this cost accounting era. That is why it is called full cost accounting, which assumes the equality of related workers for the rubles lost. There should be no indulgences here, or otherwise we will again breed collective dependents and will once more drive people to the abyss of economic injustice....

The ministries sometimes unjustifiably establish economic norms. It is gratifying, however, that the growing independence of the enterprises is beginning increasingly active in shaking loose command methods and pushing for more thoughtful, creative work. The economic-planning administration of the USSR Ministry of the Chemical Industry alone received objections from 57 of its enterprises. It was revealed that a number of collectives, for example, the Rubezh "Krasitel" Association, proved their claims to the ministry fairly and with sound arguments. The USSR Ministry of the Chemical Industry was forced to take them into consideration when formulating the plan for social and economic development for this year. It is unsuitable for USSR Gosplan to delay in working out the principles for scientific substantiation of norms. This seriously hinders cost accounting.

The same thing is true with respect to the practice of making State orders. They should be competed for, according to the concept. We have enterprises in the chemical complex, however, where the State order encompasses the entire production volume. Is it not clear that this shackles the initiative of the collectives? There is another extreme. Some director, striving for a peaceful life, himself asks to include a broad products list in the State order. It is unbelievable, but in some ministries they are willing to go half-way—for example, in the USSR Ministry of the Chemical Industry. The directive bodies determined, for this ministry, a share of the State order for commodity output, amounting to 46 percent, but the ministry specialists arbitrarily increased it to 70 percent for their enterprises. It will apparently continue this way for us until the Statute on the State Order is worked out, which is impatiently awaited everywhere.



USSR Gosplan and USSR Gosnab should precisely determine the procedure for giving State orders and the responsibility of the parties. At the same time, the work collectives should also understand the new methods of formulating the plan. This also pertains to contractual discipline. Unfortunately, not everyone is yet aware that the incomes of the collective under the new conditions can increase only on the basis of expanding the orders and reducing the expenditures.

[Question] Veniamin Georgiyevich! The major role of science in the development of our industry is well known. How quickly will the stagnant phenomena in the scientific-research subdivisions be overcome and a true contest of mind and talent be aroused?

[Answer] Tremendous scientific forces are concentrated in the country's chemical complex: about 50,000 scientific associates are working in it. Almost one-third of the scientific-research institutes and design bureaus, performing half of all the scientific work, are included in the structure of production and scientific-production associations, which makes it possible to overcome the isolation of the scientific organizations from actual practical work. In the last two years, over 200 advanced industrial processes have been developed, 80,000 persons have been released and directed toward making up the personnel of new production facilities, and an output worth a total of over one billion rubles has been obtained through modernization and technical re-equipment.

At the same time, we think that the yield from science could be considerable. Its restructuring is going slowly. The level and quality of the developments often do not correspond to today's scientific-technical requirements. Resources are often permitted to be dissipated to perform work of no scientific and practical value. In a number of cases, the ministries have exchanged sectorial science for the service of existing production facilities, to the detriment of prospective development. Financing the institutions, and not the scientific work, has fed this "science." VNII sintezbelok, engaged for over 10 years already in developing technology for making feed protein from natural gas, has spent over 15 million rubles on this, and so far, no well-developed industrial process has been surfaced. At the State Scientific Research and Planning Institute of the Nitrogen Industry and Organic Synthesis Products (GIAP), only three percent of the scientific colleagues and six percent of the designers have experience in practical work at the sector's enterprises. There are few talented young people among them. It is not by chance that most of the developments of this institute for the entire decade lag behind the world level.

The yield from science can be increased only by more energetically introducing new economic and organizational forms and setting up favorable conditions for the development of creative initiative in the work of the scientific collectives. Here, too, there is the transition of science to full cost accounting, the determination of priority developments through State orders, and the

expansion of contractual ties with enterprises. Along with this, within the scientific subdivisions, in our opinion, it should be the director of the subject and not the directorate of the institute who manages the funds for specific development. Then the scientists will act independently, with more active creativity, and more responsibly.

[Question] Quite a lot of alarming material on the harmful effect of chemistry on the environment has appeared in the press recently. This problem worries everyone. Under the conditions of glasnost, the mania has heated up. What is your opinion on this question?

[Answer] Ecological problems really require a new approach and sober rethinking of what, in the past, we did wastefully, striving at any price to attain the foreign level of chemical production and use of fertilizers and pesticides. It should, however, be said very definitely that large, stable harvests are not obtained without chemicalization of agriculture. All the practical work of world agriculture indicates this. It is another matter that in the period of rapid development of chemistry in the 1960s, we formed a superficial view of the consequences of the effect of chemistry on the environment: nature, they say, can endure anything. This was embodied in poorly thought-out schemes for locating chemical production facilities and in their excessive concentration. In the pursuit of imaginary savings in the planning decisions, nature-conservation projects were sacrificed. A tense ecological situation was formed in some cities.

The true state of affairs there, however, was outside the area of criticism. Now we are making public many negative phenomena in nature conservation work. This has naturally caused an outburst of emotion. Some authors, however, irresponsibly force an atmosphere of unpleasantness on chemistry itself. Notices interpreting ecological problems in a biased way quite often appear on the pages of periodicals. They persistently put forward the idea of the incompatibility of chemistry and a clean environment. Like any extreme, it is not so inoffensive as might appear at first glance, since it forms the corresponding reaction in those who are in power, and this can sharply lower the developmental rates of the country's chemical industry.

The so-called pesticide "scarecrow," which terrifies the public, has recently been diligently "inflated." World consumption of pesticides is increasing, however. Indeed, with unskilled use they can be truly harmful, just as the very same match can give heat or burn a house to the ground. The whole point is in the practical work of using chemicals. In England, for over a decade now, three-fold more mineral fertilizers and pesticides have been used per hectare of plowed fields than in the USSR. This, however, according to the evidence of the World Health Organization, has had no effect on the state of health of the people, and the average life span there is increasing. This trend is also observed in Japan, the FRG, and a number of other countries.

The World Health Organization attests to the fact: most of the acute poisoning by pesticides is caused by negligent treatment of them. Sometimes we store pesticides incorrectly and use them unwisely. We do not yet have enough special equipment to apply them. However, I can state with full responsibility: our country has very rigid requirements with respect to the content of pesticides in food products. Extremely emotional evaluations should give way to scientific truth, and that is the fact that the technological progress of civilization is irreversible, and chemistry is by no means an exception to this.

It has modern waste-free technology that can practically guarantee ecological stability in any region where it is located. For example, a major production association in the Ukraine—the Pervomayskiy "Khimprom" of the USSR Ministry of Mineral Fertilizer Production—where production facilities for the following are concentrated: chlorine, caustic soda, pesticides, and a number of other products, operates according to a drainage-free system. All the emissions into the air and water basins are almost completely neutralized and purified. Biological monitoring of all the emissions has been introduced at the enterprise. This approach apparently also gives a constructive impetus to accelerating the rates of chemicalizing the national economy and to keeping our environment clean.

At the same time, there must be a sharp increase in the level of the management standard and of work and technological discipline. It is no secret that at some enterprises where advanced domestic or foreign technology is used, the equipment is carelessly operated. At a number of places, accidental emissions of chemicals are not yet regarded as an unusual occurrence.

Another direction in normalizing the ecological situation is the introduction of waste-free industrial processes and the use of automated control systems. Development of these systems has begun. This requires a fairly large amount of capital, but we are proceeding with these expenditures.

The CPSU Central Committee and the Soviet government recently adopted a number of special resolutions on improving the sanitary conditions of the environment in individual regions of the country. In the first two years of the Five-Year Plan, the total gross emission of pollutants into the atmosphere has been reduced by 10 percent, including a 16 percent reduction at the production facilities of the chemical complex.

At the beginning of January of this year, the CPSU Central Committee Politburo approved State proposals for radically restructuring the work of environmental protection in the country. They should become a permanent operations guideline for everyone.

Each worker in the chemical complex must remember that he is entrusted with important, responsible work. He must have a high level of competence, creative

initiative, modern ideas, and sensible caution at the production facility in order to avoid damage to nature or people. These qualities, highly professional work habits, are of course not acquired all at once. Now, in the period of restructuring, a well-proportioned system of training and retraining personnel, including schools, PTUs, tekhnikums, VUZes, and enterprises, is particularly necessary. This is required by the resolutions of the February (1988) Plenum of the CPSU Central Committee.

The enterprises of the chemical complex have developed competition for a worthy greeting of the 19th All-Union Party Conference. It is headed by our political avant-garde—the communists. In meeting with them, one is charged with the optimism of restructuring and filled with the certainty that everything entrusted to us by the party will be fulfilled with honor.

12151

**Computer Aided Design of Pipeline Networks,  
Using Flow Charts in SAPR**

18410168 Moscow *KHIMICHESKOYE I  
NEFTYANOYE MASHINOSTROYENIYE* in Russian  
No 11, Nov 87 pp 17-18

[Article by B.I. Finkelshteyn, engineer]

[Abstract] A calculation of coordinates for pipeline networks, the results of which may be used to design pipelines and service lines, was presented and discussed. This approach makes it possible to reduce the task to a problem concerning a maze and to use a search and retrieval model, modified for the case given, for solving the problem. The search and retrieval procedure for all solutions and a model for designing pipeline networks were illustrated with algorithms and were described and discussed in the article. Figures 2. References 4 (Russian).

02791

**Computerized Unit for Producing Extra-Pure  
Etching Chemicals**

18410242a Moscow *MOSKOVSKAYA PRAVDA* in  
Russian 23 Jan 88 p 1

[Article by M. Temchina]

[Excerpt] The "Proton" is our country's first unit for obtaining extra-pure salts and acids. As components of special etching mixtures, these products are now being used more and more in electrical-equipment production, microelectronics and optics.

I walked up to the "Proton". A single operator was manning its control desk.

"The 'Proton' is a versatile computerized telemechanical complex; purification of products with it is controlled completely by electronics," said G.Z. Blyum, head of a

department of the All-Union Scientific Research Institute of Chemical Reagents and Extra-Pure Chemical Compounds. "See, we are now entering the necessary code."

I've pressed a button, and numerical data appeared on a television screen; the unit's computer was reproducing an entire purification process from its memory, on the display tube.

"Grigoriy Zakharovich, isn't it obvious that a certain number of minute particles of 'dirt' and impurities will be left in the finished product at the end of the operation, in spite of everything?"

"Special filters separate such impurities from purified substances. Incidentally, the unit's components themselves are made of sterile materials. After every piece of equipment is rinsed with water and a solution, the 'Proton' is ready to produce another acid or salt. The production process thus proceeds without interruption, and hundreds of tons of extra-pure etching agents a year can be obtained with the aid of the unit. The complex has already undergone experimental trials at chemical enterprises of our country. In terms of characteristics, substances obtained with the 'Proton' are equal in quality to the best foreign counterparts."

/9738

**Reactions of Radicals During Water Sonolysis. I. Description of Process Model**

18410169 Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian (manuscript received 11 Jul 86) Vol 61, No 11, Nov 87 pp 3041-3044

[Article by N.A. Maksimenko, V.S. Shipovskov, and M.A. Margulis; Department of Chemistry, Moscow State University imeni M.V. Lomonosov; All-Union Scientific Research Institute of Organic Synthesis, Moscow]

[Abstract] Numerical methods were used to solve a system of differential equations which describe the kinetics of change and spatial distribution in the concentration of various radicals which form during water sonolysis in an oxygen atmosphere, while considering diffusion and various reactions of the radicals. Results of the numerical experiments were compared with experimental data. Analysis of the numerical experiments substantiated some assumptions concerning the space-and-time distribution of the radicals and the change in composition of the gas phase in the cavitation bubble while the radicals are subjected to acoustic vibrations. References 8: 6 Russian; 2 Western.

02791

**Mathematical Description of Evolution of Oscillating Mode of Polymer Membrane Operation**

18410068d Moscow *TEORETICHESKIYE OSNOVY KHIMICHESKOY TEKHNOLOGII* in Russian Vol 21, No 5, Sep-Oct 87 (manuscript received 30 Jun 86) pp 606-611

[Article by Ye.P. Ageyev and A.V. Vershubskiy, Moscow State University imeni M.V. Lomonosov]

[Abstract] Internal stresses arise in industrial asymmetric membranes of polyvinyl trimethyl silane as a result of the shaping conditions. When the polymer comes in contact with an aqueous solution of a surfactant, the surface energy decreases with a corresponding drop in strength, and the cohesive forces of the inner stress locally disintegrate the material to form micropores. Initially, the hydrophobic surface of the polymer becomes hydrophilic as a result of the orientation of the surfactant molecules, adsorbed by the hydrophilic portion into the pore space. This enhances transfer of the more polar water molecules and increases total flow. The higher concentration of water in the pores causes desorption of the surfactant, an increase in surface tension, and collapse of the micropores. The mass transfer mechanism becomes activated, which enhances permeation of the surfactant, and the process repeats. Periodic changes in the mechanism of transmembrane transfer results in an oscillating mode between permeation and selectivity. In another work, a mathematical model of the process was presented, which is a system of non-linear differential equations where the conditions for auto-oscillation are determined by a system of inequalities. However,

oscillations derived by this model differ markedly from experimental data, because in the experiment, the auto-oscillating mode of membrane operation could not be maintained constantly, due to the fact that after each opening and closing of the pores, the local internal stresses which cause this phenomenon are relaxed. Therefore, the reserve potential energy partially dissipates and is partially expended on membrane restructuring. As a result, over time, the membrane enters a stationary state of either open or closed pores. In the present work, a system of differential equations is presented which reflects oscillation damping over time due to relaxation of internal stresses. A phase diagram illustrating the evolution of this type of system is analyzed, and computed oscillations are presented of surfactant concentration and porosity at various stress evolutions. The effect of surface diffusion on the mathematical model is also studied. Figures 4; references 4 (Russian).

12765

**Luminescence of Ytterbium Complexes with Certain Heterocyclic Azo Compounds and Surfactants**

18410068c Kiev *UKRAINSKIY KHIMICHESKIY ZHURNAL* in Russian Vol 53, No 8, Aug 87 (manuscript received 25 Nov 85) pp 844-847

[Article by N.S. Poluektov (deceased), S.B. Meshkova, and Yu.V. Korovin, Physical Chemistry Institute, UkSSR Academy of Sciences, Odessa]

[Abstract] Solutions of Yb (III) complexes with a number of organic ligands are known to exhibit 4f-luminescence of its ions, resulting from intermolecular energy transfer. It has also been demonstrated that addition of surfactants to solutions of dye complexes with metal cations results in an increase in luminescent intensity of the complexes. In the present work, a study was made of the effects of cationogenic surfactants on the spectral-luminescent characteristics of Yb complexes with 4-(2-pyridylazo)resorcin (PAR) and 4-(2-thiazolylazo)resorcin (TAR), both of which are widely used to determine a large number of elements, including lanthanoids. The luminescent intensity of Yb in the triple complex Yb-PAR(TAR)-cationogenic surfactant is 2.8 to 4.5 times greater than in the corresponding complexes without the surfactant. A method was developed for determining ytterbium in lutecium oxide to concentrations as low as  $3 \times 10^{-3}\%$ . Figures 2; tables 2; references 10: 8 Russian, 2 Western.

12765

**Kinetics of Albumin Adsorption on Carbon Sorbents**

18410068b Kiev *UKRAINSKIY KHIMICHESKIY ZHURNAL* in Russian Vol 49, No 5, Sep-Oct 87 (manuscript received 3 Jan 86) pp 826-828

[Article by S.V. Mikhalevskiy, I.A. Larionova, N.M. Pokrasen, V.A. Sigal, and M.P. Levchenko, Institute of General and Inorganic Chemistry, UkSSR Academy of Sciences, Kiev]



[Abstract] Carbon hemosorbents are used widely for detoxification of biological fluids. They have a high sorption capacity with respect to low and medium molecular weight substances. However, adsorption of large molecules has not been well investigated, nor that of high molecular weight substances such as proteins and polysaccharides. In the present work, a study was made of the sorption aspects of serum albumin (molecular weight 68,000 D) on carbon hemosorbents SKN and KAU, which are most frequently used in clinics. Experiments on albumin adsorption kinetics were conducted in static and columnar modes. In the first case, the protein solution was agitated in a thermostated cell at a frequency sufficient to prevent external diffusion, and samples were continuously taken to determine the protein concentration with a spectrophotometer. In the columnar mode, the charcoal was placed in a thermostated column through which an albumin solution was cycled. Samples were analyzed for total protein content by the biuret method and albumin content with bromocresol green. Model albumin solutions with an ionic strength of 0.15 and bovine blood serum, diluted with a physiological solution, were used. Comparison of data on albumin adsorption from the model solutions with that of the blood serum indicates that a somewhat lesser quantity of albumin is adsorbed from the serum than from the model solutions. This is apparently due to the sorption of other proteins, especially globulins which comprise 30-35% of the blood plasma proteins. Since albumin has the least molecular weight among the most important blood proteins and the highest concentration, a rapid and preferential sorption of albumin takes place when blood is in contact with a hemosorbent. This is probably one of the main reasons for the excellent hemocompatibility of charcoals with blood. Figures 2; references 11 (Russian).

12765

**Disintegrating Quartz Particles in Laser Beam**  
18410068a Moscow KOLLOIDNYY ZHURNAL in Russian Vol 49, No 5, Sep-Oct 87 (manuscript received 23 Jul 85) pp 987-990

[Article by N.N. Belov, Scientific Research Physical Chemistry Institute imeni L.Ya. Karpov, Moscow]

[Abstract] Droplets are known to explode in a laser beam, apparently due to the action of a steam bubble forming in the overheated portion of the droplet. The drop in radiation intensity 10.6  $\mu\text{m}$  inside water droplets with a radius of up to 10  $\mu\text{m}$  is 30-50%. Therefore, during a short radiation pulse, from the moment the steam bubble forms, almost all the droplet matter becomes heated beyond the boiling point. In the present work, a study was made of the action of a  $\text{CO}_2$  laser on quartz particles, and a disintegrating effect was observed. Calculation shows that in addition to regions

of intense heating in the particles, where the temperature exceeds the boiling point, a significant part of the particle's mass remains unmelted at the moment of heating. When the particle matter attains a temperature close to critical, a steam bubble forms which disintegrates the particle. Experiments demonstrated that coarse quartz particles of about 20  $\mu\text{m}$  are disintegrated in a TEA  $\text{CO}_2$  laser. The distribution of heat evolution within the quartz particles was found to be directly related to their radius. Particle disintegration results when a critical temperature is reached during maximum heat evolution. Figures 4; references 6: 5 Russian, 1 Western.

12765

### Synthesis, Study, and Application of Adsorbents and Ion Exchangers

18410150 Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 23, No 5, Sep-Oct 87 (manuscript received 6 Jan 87) pp 383-397

[Article by Doctor of Chemical Sciences I.Ye. Neymark, Institute of Physical Chemistry imeni L.V. Pisarzhevskiy]

[Abstract] Due to expansion in the applications of sorption processes in various industries, a need arose to further develop the theory of adsorption on solid surfaces of varying chemical nature and the scientific fundamentals of the synthesis of various types of adsorbents of varying pore structure, to study the basic rules governing ion exchange and ion exchange catalysis on carbon and other sorbents, and to study the surface chemistry of oxide-hydroxide systems. The above problems are being worked out at the Institute of Physical Chemistry imeni L.V. Pisarzhevskiy, UkSSR Academy of Sciences. The institute is coordinating research in the USSR on the synthesis and study of properties and applications of inorganic adsorbents (Doctor of Chemical Sciences I.Ye. Neymark is a representative to the application of inorganic adsorbents section of the Learned Council of the USSR Academy of Sciences). The institute is one of the basic centers for research on problems in adsorption in the Ukraine and one of the leading institutes in the USSR. The present work is a review which covers the development of theory and synthesis methods for inorganic, organosilicon, and mixed adsorbents of varying pore structure, the study of the surface chemistry of silica gels, and the synthesis and study of zeolites and polyalicates, organosilicon and silicon-elemental organic adsorbents, and carbon adsorbents and ion exchangers (the latter part was authored by I.A. Tarkovskiy). The review focuses mainly on work done at the Institute of Physical Chemistry. References 61 (Russian).

12765

**Academician Yakov Borisovich Zeldovich, in Memoriam**

18410211a Moscow IZVESTIYA in Russian 6 Dec 87  
p 2

[Text] Soviet science has suffered a grave loss. Academician Yakov Borisovich Zeldovich, eminent Soviet scholar, prominent physicist, three-time Hero of Socialist Labor, and head of the Department of Theory at the Physical Problems Institute of the USSR Academy of Sciences, died suddenly on 2 December 1987.

Ya. B. Zeldovich was born on 8 March 1914, in Minsk and went through school at the Leningrad Engineering Physics Institute and the Physical Chemistry Institute of the USSR Academy of Sciences. A scholar with an extremely wide range of specialties, Ya.B. Zeldovich made a tremendous contribution to the formation of the modern theory of combustion and detonation, the physics of explosions and shock waves, nuclear physics and the physics of elementary particles, the theory of gravitation and cosmology, high energy astrophysics, and X-ray astronomy. The contribution made by Ya.B. Zeldovich to ensuring our country's defense preparedness is invaluable.

The beginning of the scientific activity of Ya.B. Zeldovich is connected with physical chemistry. His work on adsorption, catalysis, the kinetics of chemical reactions, and hydrodynamics entered the golden archives of science. His pioneer work at the end of the 1930s on the theory of chain nuclear reactions was of great significance for the nuclear problem. Ya.B. Zeldovich devoted the last two decades of his life to theoretical astrophysics and cosmology. He obtained major results from the theory of "black holes" and neutron stars, the formation of the large-scale structure of the universe, and the theory of the early universe and the surviving radiation. Effects bearing the name of Ya.B. Zeldovich are included in the study programs of the largest radio telescopes and observatories in the world and of orbiting X-ray observatories. Scientific schools created by Ya.B. Zeldovich are in operation at institutes of physical chemistry, applied mathematics, space research, and physical problems under the USSR Academy of Sciences, at the State Astronomy Institute at Moscow State University, and at many industrial institutes. Up until the last days of his life, he gave lectures to students at MGU, directed graduate students, and met daily with disciples, among whom were members of the USSR Academy of Sciences, professors, and doctors of sciences. He is the author of excellent, basic books on many areas of physics and astrophysics.

The influence of the works of Ya.B. Zeldovich on the development of science is generally recognized throughout the world. Many of the results that he obtained have become classic, and his monographs—textbooks. He was elected a member of over ten foreign academies and scientific societies. The Communist Party and the Soviet

State valued the services of Ya.B. Zeldovich highly. He was three times awarded the title of Hero of Socialist Labor and was the recipient of three Orders of Lenin, Orders of the October Revolution, the Red Banner of Labor, and other awards. Ya.B. Zeldovich has won the Lenin and State Prizes of the USSR.

Passionate devotion to science and sensitivity and benevolence toward people earned Ya.B. Zeldovich well-deserved respect and authority. The blessed memory of the eminent Soviet scholar Ya.B. Zeldovich will live forever in the hearts of the Soviet people.

M.S. Gorbachev, V.I. Vorotnikov, A.A. Gromyko, L.N. Zaykov, Ye.K. Ligachev, V.P. Nikonov, N.I. Ryzhkov, N.N. Silyunkov, M.S. Solomentsev, V.M. Chebrikov, E.A. Shevardnadze, V.V. Shcherbitskiy, A.N. Yakovlev, P.H. Demichev, V.I. Dolgikh, Yu.F. Solovov, N.V. Talyzin, D.T. Yazov, A.P. Biryukova, A.F. Dobrynin, A.I. Lukyanov, V.A. Medvedev, G.P. Razumovskiy, I.V. Kapitonov, G.I. Marchuk, Yu. D. Maslyukov, B.L. Tolstykh, V.A. Grigorev, L.D. Rabev, V.A. Kotelnikov, Ye.P. Velikhov, V.I. Il'ichev, V.A. Koptug, A.A. Logunov, G.A. Mesyats, Yu.A. Ovchinnikov, P.N. Fedoseyev, K.V. Frolov, A.L. Yanshin, G.K. Skryabin, N.N. Bogolyubov, M.A. Markov, A.M. Prokhorov, A.P. Aleksandrov, H.G. Basov, A.S. Borovik-Romanov, A.V. Gaponov-Grekhov, V.I. Goldanskiy, A.D. Sakharov, I.M. Khalatnikov, Yu.B. Khariton.

12151

**Statistical Regulation of Laser Initiation of Exothermic Decomposition of Lead Azide**

18400170b Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian (manuscript received 23 Jun 86)  
Vol 61, No 11, Nov 87 pp 1425-1428

[Article by Ye.I. Aleksandrov, A.L. Bondarenko, and V.P. Tsipilev, Tomsk Polytechnic Institute imeni S.M. Kirov]

[Abstract] The effects of laser irradiation and the dimensions of the region excited on statistical regularities of laser initiation of the exothermic decomposition of lead azide were described and discussed. Pressed lead azide samples were irradiated by  $^{60}\text{Co}$  with  $\gamma$ -quanta of energy at 1.33 MeV. Exposure doses were  $10^5$ - $10^7$  R. The study showed high sensitivity of statistical regularities of laser initiation of the exothermic decomposition to radiation-stimulated change in the lead azide structure and light energy distribution within the samples. The study showed the focal nature of initiating exothermic decomposition in lead azide by the effect of laser irradiation. The possibility of using probability correlations in observing the structural degradation of heavy metal azides under the effect of intense external factors such as radiation was shown. Figures 2; references 5 (Russian).

02791

**Electrochemical Composite Coatings Made from Disperse Diamond Powder**

18410140b Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 60, No 10, Oct 87 (manuscript received 16 Jul 85) pp 2211-2214

[Article by G.N. Znatenskiy and I.A. Tsisar, Vinnits Polytechnic Institute]

[Abstract] The effect of electrodeposition conditions on the properties of galvanic coatings, containing a disperse diamond powder was investigated in order to obtain high diamond concentrations in the surface layer. A horizontal bronze cathode was used with nickel-, copper-, iron-, cobalt-, or zinc-containing electrolytes. The concentration of diamond powder in the composite layer depended on both diamond concentration in the electrolyte and the height of the electrolyte column at the cathode. Polarization increased in the presence of diamond, due to the dense diamond layer on the cathode, which hindered metal ion diffusion. For a diamond powder with 5-7  $\mu\text{m}$  diameter particles, the coating concentration achieved a maximum of 35% when the electrolyte concentration was 0.5 kg/m<sup>3</sup>. The limiting current for nickel deposition decreased with increasing diamond concentration. This is also due to hindered diffusion at higher diamond concentrations. With larger diameter (14-20  $\mu\text{m}$ ) particles, increased concentration in the electrolyte led to uninterrupted increases in coating diamond levels, with the limiting current exhibiting a small decrease only above 5 kg/m<sup>3</sup>. The more porous diamond layer formed from coarse powder does not hinder ion diffusion. When the overall cathode current density was increased, bond microhardness was increased for iron, cobalt, and nickel but was unchanged for copper and zinc. The procedures developed permit achievement of layers with diamond concentrations of from 5 to 60%. Figures 2; references 14: 9 Russian, 5 Western.

12126

**Photoelectric Properties of Polypropylene Sulfide**

18410140a Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 29, No 10, Oct 87 (manuscript received 7 May 86) pp 2186-2194

[Article by A.R. Tameyev, T.S. Zhuravleva, A.V. Vannikov, V.A. Sergeyev, V.A. Nedelkin and S.A. Arnautov; Institute of Electrochemistry imeni A.N. Frumkin, USSR Academy of Sciences; Institute of Elemental Organic Compounds imeni A.N. Nesmeyanov, USSR Academy of Sciences]

[Abstract] Pulsed photoconductivity, dark electrical conductivity, steady-state photoconductivity, and photovoltaic effects were studied in amorphous polyphenylene sulfide films prepared by various methods. The effect of organic electron acceptor additives on pulsed and steady-state photoconductivity was also investigated. Thermal extrusion, vacuum thermal evaporation-deposition, or solution immersion were used to prepare the films, into which silver, gold, aluminum, or copper electrodes were introduced by vacuum evaporation of the metal. Addition of tetranitryl pyromellitic acid or tetracyano quinodimethane to the films increased the photocurrent. The pulsed photocurrent relaxation kinetics observed demonstrated the dispersion character of charge carrier transport in the films. Activation mobility was temperature dependent. While films prepared by thermal extrusion corresponded to previously reported findings, films prepared by evaporation-deposition did not. For the latter, volt-ampere characteristics in the superlinear region were analyzed in parallel with the dependence of activation energy on potential. Regions in which the dominant current is limited by spatial charge and by injection of charge carriers, as well as a transitional region, were observed. The results indicate that the charge holes in these films exhibit a Gaussian energy distribution. Since the drift mobility of charge carriers is insignificantly altered by doping, the increased photocurrent observed is caused by increased carrier concentration. Decreasing film thickness also increased photoconversion efficiency. Figures 5; references 28: 13 Russian, 15 Western.

12126



**Effect of Encapsulation and Nitrification Inhibitors on Effectiveness of Nitrogen Fertilizers in Growing Barley on Sod-Podzolic Soils**

18410200a Moscow AGROKHIMIYA in Russian  
(manuscript received 1 Dec 86) No 11, Nov 87 pp 19-26

[Article by V.N. Yefimov, A.I. Osipov, L.N. Osipova, and L.V. Mikhaleva; Leningrad Agricultural Institute; All-Union Scientific Research Institute of Agricultural Microbiology, Leningrad]

[Abstract] Experiments conducted from 1982-1983 on poorly cultivated and well-cultivated sod-podzolic soils were described and discussed. Use of cyanoguanidine, cyanopyrimidine, and ATS in vegetation experiments showed that the nitrification inhibitors cyanoguanidine and ATS reduced the physiological activity of initiators of the first phase of nitrification but had no effect on initiators of the second phase nor on a number of other groups of microorganisms. Cyanoguanidine stimulated the accumulation of cellulose-forming bacteria. Use of nitrification inhibitors on sod-podzolic lightly-cultivated soils increased barley grain yield by 7-11%, but it was ineffective on well-cultivated soils in the vegetation and field experiments conducted. The effectiveness of encapsulated nitrogen fertilizers used on sod-podzolic soils for barley depended upon the chemical composition of the capsule and its thickness. Use of chlorinated polyethylene encapsulated ammonium nitrate with an increased membrane thickness of 9.8-16.8% of the mass of the granule reduced barley grain yield from 19.4-11.1 g/container on poorly cultivated soils and from 24.9-17.1 g/container on well-cultivated soil. Encapsulation of urea and ammonium nitrate in 1983 did not affect barley grain or straw yield as compared to standard forms of nitrogen fertilizers. Use of urea, encapsulated by chlorinated polyethylene or calcium silicate, in 1982 increased the output coefficient of nitrogen fertilizers and decreased gaseous losses, while nitrogen fixation in the soil was practically unchanged. A table showing the effect of fertilizer encapsulation on barley grain yield was presented and discussed. Capsules consisting of chlorinated polyethylene, organosilicon compounds, carbamide-formaldehyde resin, and calcium silicate were used. References 12 (Russian).

02791

**Successes of the Mineral Fertilizer Industry**

18410202a Moscow KHIMIYA V SELSKOM  
KHOZYASTVE in Russian No 11, Nov 87, pp 5-9

[Article by A. A. Kochetkov, first deputy minister of mineral fertilizer production]

[Text] Speaking at the June (1987) plenary session of the CC CPSU, General Secretary Gorbachev noted: "...At the present stage, all objective conditions have been created to bring about something of a surge in expanding agricultural production." An important role in such

acceleration is played by widespread use of mineral fertilizers and chemicals for plant protection. Their volumes of use characterize the level of chemicalization of agriculture.

In the USSR, definite successes have been achieved in this area. The production of mineral fertilizers is growing rapidly: while in 1965, 7.4 million T d.v. were produced, in 1986, the figure was 34.7 million, 1.65 fold larger than that in the USA. Even so, there is still not enough fertilizer in the USSR. The doses of fertilizer for grain crops are inadequate, and too little is being used on the meadows and pastures. Therefore, in the 12th Five-Year Plan, the development of the sector will also proceed at a quickened pace. It is planned to supply agriculture with a total of 140 million T NPK in the five-year period, which will enable a supply of mineral fertilizers on the level stipulated by the USSR Food Program in 1990.

Soviet industry produces practically all fertilizers known in worldwide practice. But the assortment varies, depending on the requirements of agriculture. In recent years, the production of complex fertilizers has received preferential development in the sector. This made it possible to increase the concentration of nutritive substances in the fertilizers from 29.4% in 1970 to 41.7% in 1985. Thanks to this, an enormous savings was realized in the expense of delivery, storage, and application of fertilizer. However, with the transition to intensive technologies of crop cultivation, the demand for simple fertilizers has risen sharply. In this respect, the production of the simple phosphorus fertilizers in shortest supply will nearly double in the current five-year period. And in the 13th Five-Year Plan, the entire increment in fertilizer production will come from the simple forms alone.

There are complaints about quality of fertilizers. For example, the ammonium nitrate cakes, some of the nitrophoska, the nitroammophoska, and the granulated superphosphate are not up to standard. The consumers are not always satisfied with the potassium fertilizers either, since few of them are still made in granulated forms.

The comprehensive program "Quality" has been worked out and is being successfully implemented in the sector. In compliance with it, we are striving to provide agriculture with nitrogen and phosphorus fertilizers solely in granulated form, and potassium fertilizers in granulated and large crystal forms. The major solution to the problem is conversion of the enterprises to production of new forms of fertilizer with better physical-mechanical and chemical properties. The Cherepovetsk PO Ammofos, for example, is making high quality diamphos and diamphoska, the Balakov Chemical Combine ammophosphate, and the Gornel Combine excellent fertilizers for hot-house produce.



In the 12th Five-Year Plan, there are plans for intensifying the production of fertilizers, a reorientation of the investment and structural policies, and increased capital investments in redesign and technical reoutfitting of the enterprises. Scientific-technical progress in the sector is being realized by modernizing the technology and using equipment of large unit capacity. This is very conspicuous from the example of the production of ammonia and its attendant nitrogen fertilizers. At present, around 40 units, each with a daily output of 1300 T of ammonia, are operating in the sector. A plasmachemical method of producing nitric acid directly from air is being worked out, which will considerably increase the output of nitrogen fertilizers.

The Soviet Union holds first place in ammonium nitrate production in the world. Although the share of this in the overall production volume of nitrogen fertilizers will decline, the output in absolute terms will increase. In the production of ammonium nitrate, an automated technological process in units (each with a 450-520 thousand T annual capacity) with a closed cycle is being created. This will provide a boost in labor productivity, more complete utilization of secondary energy resources, and lower net production costs.

The production of carbamide, the most concentrated of the solid nitrogen fertilizers, is rapidly developing. Units with 350 and 450 thousand T/yr capacity are being introduced in the sector, providing a 2-3 fold increase in labor productivity and a sizable reduction in energy costs.

Production of a new form of liquid nitrogen fertilizer is being organized: a 32% solution of ammonium nitrate carbamide (KAS), containing no free ammonia. Carbamide-ammonia mixtures are cheaper to produce, due to elimination of a number of steps in the technological process, and the labor expenses of storage and application are substantially reduced (thanks to total mechanization of loading and unloading).

It is advisable to use nitrification inhibitors to enhance the effectiveness of nitrogen fertilizers. The production of fertilizers with nitrification inhibitors will already take place on an industrial scale in this five-year period. The use of such fertilizers will lower the nitrogen lost and reduce the danger of environmental pollution.

The production of phosphorus fertilizers entails the greatest difficulties for our sector. The supply of phosphorus fertilizers increased from 3.1 million T d.v. in 1970 to 8.4 million in 1985. Nevertheless, despite the enormous resources invested in developing the phosphorus fertilizer industry, it has not yet been possible to solve the problem of their supplying the necessary amounts to agriculture. Expansion of phosphorus fertilizer production is being held back by a shortage of concentrated raw material. The entire increment in extraction of phosphorus-containing raw material will come from the hard-to-mine ores of the Karatau basin,

and also from opening new mines in uninhabited regions with severe climatic conditions. By the year 2000, the net cost of 1 T of phosphorus pentoxide from all types of raw material will increase significantly beyond that of 1975, while specific capital investments will increase by a factor of 2.4. Therefore, work involving incorporating new methods of subsurface and open cut phosphate ore mining, hydraulic mining, and underground leaching into production is being intensified. New forms of fertilizers obtained from lean ores are being developed and tested in industrial conditions. In particular, superphos made by a new technology with an economized expenditure of sulfuric acid holds promise. Calcium polyphosphate (41%  $P_2O_5$  and fused magnesium phosphates will be produced.

A rather complicated situation has come about in the potassium fertilizer industry. Due to the shutdown of the high-volume mine of the "Uralkaliy" Association for mining and geological reasons, the output of potassium fertilizers dropped in 1986, and only 93% of the plan was fulfilled. Measures were taken in the sector to liquidate debts, and the plan for the first half of 1987 was fulfilled by 101.7%. To boost production, layer and selective mining complexes for potassium strata and new combines able to increase the percentage of ore mined are being introduced. At mines with complicated mining and geological conditions, non-shaft methods of mining potash are being developed. A fundamentally new process is electrostatic separation, which can produce a 95% salt concentrate with major savings in energy expenses.

At the moment, potassium chloride holds the leading place in the assortment of potassium fertilizers. A goal has been set to expand the production of nonchloride potassium fertilizers, especially potassium sulfate. There are plans to create and introduce a continuous process for production of nonchloride potassium fertilizers.

Special attention in the sector is being devoted to production of plant protection chemicals. This is due to a disproportion in the development of the industry of mineral fertilizers and pesticides. Agriculture requires around 150 preparations, while the industry produces less than 100. Although vast resources are being spent to purchase preparations abroad, it has not yet been possible to meet the full demand of farmers for pesticides. As a result, a considerable portion of the nutritive substances of mineral fertilizers do not "work" for the harvest.

The ministry has worked out a comprehensive program for development of the pesticide industry. In accordance with this, the supply of pesticides to agriculture in 1990 will increase by 115 thousand T, as compared to 1986. In 1995, the basic demand of agriculture for plant protection chemicals should be met. There are plans to develop the production of low-toxicity preparations to be used in small doses, which rapidly decompose in nature. Joint enterprises will be created, especially with the CEMA countries.

Intensification of the production of fertilizers involves radical improvement in the use of natural resources, raw materials, fuel, and energy. The ministry has worked out a comprehensive program for economizing each year of the 12th Five-Year Plan. The 1986 program included around 300 economizing measures, the realization of which enabled a savings of 250,000 T sulfuric acid, 109,000 T apatite concentrate, 29,000 T ammonia, and many other resources. The sector is one of the most energy-intensive, and therefore, much attention is devoted to utilization of energy resources. Thanks to the use of secondary heat resources, around 25% of the thermal energy requirement of the enterprises is being met. In the present five-year period there should be a substantial increase in this index; broad use of automated accounting and electricity metering systems is also being planned.

In 1986, the ministry invested 75.8 million rubles in environmental protection, putting 28 environmental protection facilities into operation. Thanks to organizational and technological measures carried out at the enterprises of the sector, the emission of harmful substances into the atmosphere was reduced by 22,000 T in 1986, and the discharge of contaminated waste into bodies of water by 33 million cubic meters. At the "Apatit" PO, the daily discharge of polluted waste waters was reduced by 400,000 m<sup>3</sup> with the introduction of new technological schemes and regimes, enabling use of recycled water. At present, more than two-thirds of the enterprises of the ministry discharge no waste at all into water bodies.

We entertain great hopes for reconstructing the operation of the sector and converting from administrative to economic methods of management. Fulfillment of shipment orders has become the principal index for evaluating the operation of enterprises. Reconstruction has boosted this index to 97% in 1986, versus 93.3 in 1985. At present, 71 enterprises have accomplished or come very close to satisfying the vitally important index of appraisal: contractual obligations. Moreover, workers at a number of enterprises have appealed to the ministry for an increase in the production plans for various product types. This testifies that the new management conditions are stimulating the activity of the enterprises. Several plants and enterprises are cutting back the volumes of raw material previously submitted to the plans, striving for a more economical expenditure of material and energy resources.

As of 1 Jan 1987, State Acceptance of Products has been introduced at 35 enterprises in the sector. This was preceded by huge preparations: assistance was rendered in making up the acceptance staffs, technical inspection services were strengthened and reorganized, technical regulations were reviewed and revised, OTK workers were given further training, and their premium wage conditions were revised. To strengthen the role of the technical inspection services, the majority of enterprises have introduced the position of director of quality, and the wage scales of the inspectors and lab technicians have

been revised. Output of high quality products has become the single criterion for evaluating the work of the technical inspection services.

State Acceptance has made it possible to disclose "bottlenecks" in enterprise operation. The reasons for product rejection are inadequate measurement equipment and dispensers, lack of railroad car preparation and tank car processing stations at several enterprises, and poor quality of sacks and recycled crates.

As of January 1988, the sector will convert to full self-management and self-financing. This is a complicated matter, with many unresolved problems. For example, some of the enterprises are currently operating at a loss. The issue therefore arises of granting more extensive rights to the enterprises, of making them self-sufficient on the basis of total self-management, and of creating a favorable economic environment for them. We are tying the success of reconstruction to conversion of the work force to self-management, when they will decide all issues of internal organization of production themselves. More effective use of all forms of self-management of the work force has been decided upon for greater democratization.

An important role in the development of the creative activity of the workers is assigned to socialist competition. Efforts of the competitors are concentrated on achieving high labor productivity, increasing the output of products of superior quality, saving on material and fuel-energy resources, fulfilling all contractual obligations for shipments, searching for effective engineering and design strategies, and strict observance of work, technology, and production discipline.

Preference is given to work groups which have achieved a substantial increase in labor productivity, better product quality, and savings in resources, while fully meeting the contractual obligations for shipments and the construction plans for residential, cultural, and amenity facilities. Groups not meeting contractual obligations, producing poor quality products, or tolerating an amendment of the plans in the direction of lower production, are eliminated from the claimants for victory in socialist competition.

Reconstruction of the sector is bearing fruit. Enterprises met the plan for the first half of 1987 for production of mineral fertilizers, chemicals for plant protection, and a number of other critically important product types. Above and beyond the plan, 720,000 T of mineral fertilizers were supplied to agriculture. The enterprises and organizations of the ministry fully complied with the goals of developing commercial production of new product types and introducing progressive technologies.

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**Mathematical Model of Molecular Beam Scattering on Gas Target**

18410204c Moscow ZHURNAL FIZICHESKOY KHIMII in Russian (manuscript received 8 Apr 86) Vol 61, No 10, Oct 87 pp 2759-2763

[Article by A.V. Lazarev, N.N. Zastenker, and D.N. Trubnikov, Department of Chemistry, Moscow State University imeni M.V. Lomonosov]

[Abstract] A simple model of an experiment on molecular beam scattering on a gas target, based on the first approximation of an iterative solution of Boltzman's equation, was described and discussed. Use of the model permitted correct calculation of the contributions of single collisions in a flow of particles, scattered in a detector with a finite aperture. A value for the percent error was calculated, using the Rozin-Rabi formula (9). Actual calculations, using (9), were performed numerically with an accuracy of at least 0.5% for Xe, Kr, Ar, and Ne scattering on a helium target in the velocity range  $10^4$  cm/s to the maximum velocity for each gas. This value may be significant when scattering a beam of heavy particles on a target of light particles (He). Increasing the temperature of the target decreased the value of (9). Figure 1; references 16: 2 Russian; 14 Western.

02791

**Formation of Optimally Smooth Optical Glass Surfaces**

18410197a Leningrad FIZIKA I KHIMIYA STEKLA in Russian (manuscript received 26 Jun 86) Vol 13, No 5, Sep-Oct 87 pp 740-746

[Article by G.V. Dudko, A.A. Kravchenko, and D.I. Cherednichenko, Taganrog Radio Engineering Institute imeni V.D. Kalmykov]

[Abstract] Preparation of an optical glass surface of prescribed quality for solution of problems in optics, acousto-optics, integral optics, and laser optics is a vital problem at the present stage of development of the technology. Experimental studies have shown the significant dependence of such parameters of articles as chemical stability, radiation resistance, and mechanical strength on the state of the surface. In view of this, a qualitative analysis of processes ensuing during hardening of a glass surface, determination of regimes and conditions of formation of an atomically smooth surface, and experimental checking of results obtained were described and discussed. Surface heat treatment of samples of K8 optical glass discs with a 30 mm diameter and a 5 mm thickness was performed with a low-energy electron beam as a heat source. Local micropolishing by a uniformly moving heat source and subsequent hardening of the surface may produce a microrelief in the form of ripples, resulting from hydrodynamic flows in the metal. Their intensity depended upon the temperature drop within the liquid zone. A processing regime may be selected so that the liquid zone sets more quickly than

the rippling forms, and this produces an atomically smooth surface. Conditions for establishing such a regime were described and discussed. It was established experimentally that it is possible to produce a glass surface with a microroughness height of no more than 15-20 Angstroms while preserving the original geometry of the article. The resulting flatness of the optical glass is no worse than  $\lambda_2/10$  when the disc diameter is 30 mm. Figures 3; references 13: 10 Russian; 3 Western.

02791

**Method for Producing Semiconductors**

18410244b Moscow TASS in Russian 0938 GMT 18 Jan 88

[Summary] An original method for producing semiconductors which are widely used in cybernetics, solar power generation, and fiber optics has been developed by scientists at the Moscow Institute of Fine Chemical Technology. For the first time in world practice, they succeeded in "programming" the structure in advance and in producing semiconductor crystals with required properties.

Professor Vsevolod Ufimtsev told a TASS correspondent that this is achieved by means of doping, i.e., the strictly controlled introduction of special admixtures into a purified crystal of silicon or other materials. So far, the scientists have been unable to control the precise properties of semiconductor materials with dopants by any other way. With doping, many characteristics of semiconductors and the instruments created with them are improved.

Professor Ufimtsev said that the technology for producing semiconductors with required properties has made it possible to create a whole new class materials which can be used in various areas of technology and in the development of a new generation of computers. Physicists, chemists, and engineers have been involved in the work. This has made it possible not only to make a contribution to theoretical science but to raise the production of semiconductor instruments rapidly to a qualitatively new level.

/9738

**Powders for New-Generation Ceramics Produced by New Process**

18410242b Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 9 Feb 88 p 2

[Article by R. Akhmetov (Moscow)]

[Excerpt] Scientists of the Moscow Chemical Engineering Institute imeni Mendeleyev have again demonstrated their ability to advance promising research directions rapidly. Tests of a process for obtaining powders



which are needed in production of new-generation industrial ceramics were successfully completed yesterday at this higher school's experimental plant.

"Industrial ceramics are mentioned more and more often by specialists as candidates for roles of materials of the future," noted Professor A. Vlasov, one of the authors of this development. "Possessing high strength and resistance to heat and corrosion, these materials surpass metals in many cases."

By uniting the efforts of scientists of two chairs of instruction and specialists of the experimental plant, the Moscow institute quickly developed a ceramic which is twice as strong as similar materials and capable of operating at temperatures as high as 2,000 degrees. Following orders received from industry, the scientists will begin producing key parts made of this ceramic for various machines and mechanisms at their plant.

/9738

#### Structure, Properties, and Sintering of Doped Lead Titanate

18410151c Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR: SERIYA KHIMICHESKAYA in Russian No 5, Sep-Oct 87 (manuscript received 14 Jan 87) pp 542-546

[Article by Z.P. Milberg, R.Z. Kleyne, T.K. Kutuzova, and E.Zh. Freydenfeld, Riga Polytechnic Institute imeni A.Ya. Pelshe]

[Abstract] Lead titanate in dense ceramic form can only be prepared by doping. The best doping agent has been established to be  $\text{La}^{3+}$  in a pre-synthesized complex form. In the present work, a study was made of the effects of these dopants on the structure and properties of lead titanate ceramics and the relationship between sintering kinetics and glass concentration. Lanthanum ions were incorporated into the lead titanate by three methods: 1) conventional ceramics technology, where it was synthesized from oxides at 1120 K for 1800 s, 2) sintering from a mixture of pre-synthesized lead titanate and lanthanum dititanate, 3) sintering mixtures of pre-synthesized compositions having varying amounts of lanthanum ion. Within the system  $\text{Pb}_{0.898-0.874}\text{La}_{0.008-0.0218}\text{Ti}_{0.877}\text{Sn}_{0.098}\text{Mn}_{0.028}\text{O}_3$ , a material with high piezoelectricity ( $d_{31}$  = up to  $90 \times 10^{-12}$  Coul/N), strong anisotropy in piezoelectric properties ( $d_{33}/d_{31}$  = 7.5), and a mechanical quality factor of up to 5300. The high mechanical quality factor was attained by doping with tin and manganese oxides. Addition of 2-3 weight % lead-silicate glass raises the sintering rate and improves both the ceramic and electro-physical properties of lead titanate piezo-ceramics. Adding higher amounts of glass (up to 15 wt. %) results in deterioration of apparent density (up to  $7.3 \times 10^3$  kg/m<sup>3</sup>), an increase in open porosity (up to 0.31%), and deterioration of piezoelectric properties. Figures 6; references 8: 5 Russian, 3 Western.

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#### Heterophase Reactions of Molybdenum Disulfide and Dibromide in Reducing Media under Continuous Carbon Dioxide Laser Irradiation

18410151a Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 53, No 10, Oct 87 (manuscript received 24 Mar 86) pp 1011-1013

[Article by A.F. Gurko, V.L. Kolesnichenko, I.I. Timoshchenko, and S.V. Volkov, Institute of General and Inorganic Chemistry, UkSSR Academy of Sciences, Kiev]

[Abstract] Most recently realized laser-chemical reactions are gas phase, although there is great interest in heterophase reactions. The dynamics of reactions taking place on a solid target in an atmosphere of reagent gases under an IR-laser can be complex, as in the oxidation of copper with oxygen and in other reactions. A very rapid and sharp change in the temperature of the target under laser irradiation, as well as a reversed relation between the thermal and chemical degrees of freedom of the initial and final components, could result in stabilization of non-trivial products. Experimental data must be accumulated to clarify the possibility of such processes occurring. Certain chalcogenide and chalcogenide compounds of molybdenum are known to have desirable physicochemical properties (semiconductors, superconductors having high critical temperatures and critical magnetic fields, and others). They are synthesized in the solid phase by the ampule method, as a rule, from the elements at high temperatures (1100-1500 K) over a long period of time. It is therefore interesting to study the process of heterophase conversion of molybdenum disulfide and dibromide in reducing media (hydrogen, hydrogen sulfide, and carbon disulfide) under continuous carbon dioxide laser irradiation. An ILGN-704 carbon dioxide laser of 40 Watts power was used to generate radiation at  $943 \text{ cm}^{-1}$  frequency. A diagram shows a laser beam reflected from a flat or spherical mirror to a molybdenum disulfide or dibromide target placed in a cylindrical pyrex cuvette, having a KRS-5 entry port. The cuvette was filled with an inert gas (argon) or a reducing gas (hydrogen, hydrogen sulfide, or carbon disulfide). The IR-radiation intensity varied from 1-500 W/cm<sup>2</sup>. Conversion products were identified by X-ray analysis. To clarify the features of molybdenum disulfide conversions, the process was first studied in argon, where it was determined that  $\text{Mo}_2\text{S}_3$  formed after 3000 seconds at 40 W/cm<sup>2</sup>. Molybdenum disulfide reacted with hydrogen at 10 W/cm<sup>2</sup> with 3600 seconds exposure time to yield metallic molybdenum and a phase of unknown composition. A reaction between molybdenum disulfide and dibromide was initiated at 40 W with 1800 seconds exposure time to yield  $\text{Mo}_2\text{S}_3$ , Mo, and an unidentified phase. Molybdenum dibromide reacted with hydrogen sulfide at 40 W to yield metallic molybdenum and with carbon disulfide to yield  $\text{Mo}_2\text{S}_3$ . Figure 1; references 11: 8 Russian, 3 Western.

12765



**Production and Properties of Neodymium Ultraphosphate Glass**

18410197d Leningrad FIZIKA I KHIMIYA STEKLA in Russian (manuscript received 12 Nov 85) Vol 13, No 6 Nov-Dec 87 pp 894-896

[Article by L.G. Bebikh, V.F. Surkova, Ye.I. Koryagina, I.M. Buzhinskiy, and B.N. Litvich, Moscow State University imeni M.V. Lomonosov]

[Abstract] Damen, et al., reported production of ultraphosphate glass (UPG) with the composition  $\text{Nd}_2\text{O}_3 \cdot 5\text{P}_2\text{O}_5$  in airtight ampules. The glass exhibits laser properties. Later, glass very similar to this in composition and properties was produced by melting crystalline ultraphosphate under phosphorus pentoxide vapor pressure. Improvement of this method has made it possible to produce UPG samples in different forms with a size of up to 50 cm<sup>3</sup>. This article describes production of UPG by using fine-crystalline ultraphosphate, produced from an aqueous solution of phosphoric acid by the Litvich and Chudinov method as the starting material. The hydroxyl level in it did not exceed the quantity permissible for laser crystals. UPG was melted in glass-carbon crucibles in a phosphorus pentoxide atmosphere at 1100-1200° C. The phosphorus pentoxide level was set by a weighed sample of  $\text{P}_2\text{O}_5$ . The composition of the UPG produced depended on the melting time and the amount of pentoxide introduced. Basic characteristics of neodymium UPG were presented in a table and discussed. High quality samples were produced by using  $\text{Ce}_2\text{O}_3$ ,  $\text{Gd}_2\text{O}_3$ , and  $\text{La}_2\text{O}_3$ . The dependence of the number of emitting centers on the concentration of neodymium ions in lanthanophosphate glass was illustrated. The number of radiating centers increases up to maximum concentration, which shows the high feasibility of the glass for laser applications. Figures 1; references 10: 7 Russian; 3 Western.

02791

**Physicochemical and Spectral-Luminescent Characteristics of Neodymium Glasses Based on Tellurite**

18410197c Leningrad FIZIKA I KHIMIYA STEKLA in Russian (manuscript received 31 Dec 86) Vol 13, No 6, Nov-Dec 87 pp 866-973

[Article by G.Ye. Malashkevich, N.V. Ovcharenko, T.V. Smirnova, A.S. Gigevich, A.V. Mazovko, and V.N. Tadeush, Institute of Physics, BSSR Academy of Sciences, Minsk]

[Abstract] Data concerning spectral-luminescent characteristics of neodymium glasses on a tellurite base are scarce and contradictory. They are also presented without reference to other physical characteristics, which makes it difficult to assess the prospects for using such materials as active elements in lasers. This article described an attempt to fill this gap by performing the synthesis and a thorough study of alkali-free tellurite

glasses with a wide range of variation in  $\text{Nd}^{3+}$  concentration. Glasses were synthesized in corundum crucibles under oxidizing conditions at a temperature of about 1000° C by usual methods. The  $\text{Nd}^{3+}$ -activated alkali-free glasses had physicochemical characteristics equal to those of series-produced neodymium glasses on a phosphate base. Although the luminescence of tellurite-based glasses is not quenched at low concentrations, the relatively high cross section of radiative transitions of the activator from the metastable state and the low inert absorption at  $\lambda = 1.06 \mu\text{m}$  justified classifying them as a low-threshold laser material. The rather rapid relaxation of highly-excited states of neodymium ions suggested the feasibility of using them as highly-concentrated active materials in systems with short pumping pulses. Figures 3; references 12: 6 Russian; 6 Western.

02791

**Isomorphism of Scandium in Aluminum and Gallium Garnets of Rare Earth Elements**

18410174b Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 297, No 6, Dec 87 (manuscript received 30 Mar 87) pp 1410-1413

[Article by S.Yu. Zinovyev, V.A. Krzhizhanovskaya, and V.B. Glushkova, presented by Academician M.M. Shults 4 Mar 87]

[Abstract] Scandium-containing aluminum and gallium garnets of rare earth elements are promising materials for active media for solid state lasers. Octahedral encirclement appears to be the preferential configuration of  $\text{Sc}^{3+}$  cations in the garnet structure. It must also be kept in mind that inclusion of scandium in an octahedral position of a rare earth garnet will result in a marked increase in parameters of the nuclear shell of these compounds, since the ionic radius of  $\text{Sc}^{3+}$  is much greater than that of  $\text{Al}^{3+}$  or  $\text{Ga}^{3+}$ . The literature has many references on growing single crystals of Ln-Sc-Al(Ga)-garnets, although the isomorphic inclusion of scandium in these compounds has not yet been studied. The purpose of the present work was to synthesize scandium-containing aluminum and gallium garnets of rare earth elements and to study the isomorphic substitution of scandium into various coordinate positions of the structure. Specimens for the study were obtained by solid phase synthesis from oxide mixtures of  $\alpha$ -alumina,  $\beta$ -gallium oxide, scandium oxide, and lanthanum oxides. The limits of isomorphic substitution at the octahedral nodes of the garnet crystal lattice were studied using a pseudo-binary system whereby the concentration function of the rare earth nuclear shell parameter was compared with theoretically calculated values based on an empirical formula. In many cases, the lattice parameter of such solid solutions grew with an increasing scandium fraction beyond the limits of a single phase region. A continuous series of solid solutions was observed only in the system  $\text{Nd}_3\text{Ga}_2\text{Ga}_3\text{O}_{12}$ - $\text{Nd}_3\text{Sc}_2\text{Ga}_3\text{O}_{12}$ . In all other cases, isomorphic substitution was limited. Analysis showed that the limit of isomorphic substitution is

basically a function of the size of the cation in the dodecahedral position, and as the ionic radius of the lanthanide decreases, the volume of the garnet nuclear shell becomes smaller, so that introduction of relatively large scandium cations in the octahedral position becomes more difficult. Figures 2; tables 2; references 11: 2 Russian, 9 Western.

12765

**Acid-Base Properties of Fluorogermanates in Alkali Metal Nitrate Melts**

18410174a Moscow ELEKTROKHIMIYA in Russian  
Vol 23, No 11, Nov 87, (manuscript received 22 May 86) pp 1566-1570

[Article by M. Dratovski and M. Ukhilova, Chair of Inorganic Chemistry, Karlov University, Prague, ChSSR]

[Abstract] Acid-base reactions of oxo-compounds and halides in nitrate melts have been studied previously, and ionic halides have been found to behave similar to Lewis bases in this medium. According to preliminary data, covalent and complex halides react with molten

nitrate to give a nitrous oxide-oxygen mixture and behave as Lewis acids. This reaction was further studied using fluorogermanates to determine the possibility of forming fluoro-oxo-germanates, which have not yet been prepared, except for  $K_4[Ge_2F_{10}O]$ . Germanium compounds are different in this respect from silicon or tin compounds, which include a great number of fluoro-oxo-anions. These substances could also be of practical interest due to the special physical properties of certain fluorogermanates and germanates and their application in luminescent germanate lasers, holograph technology, color television screen coatings, production of electro-optical semiconductors, ferroelectric ceramic fibers, and other branches of technology. In the present work, potentiometric measurements were made with an oxygen electrode, and the acid-base behavior of  $Na_2GeO_3$ ,  $GeO_2$ ,  $K_4[Ge_2F_{10}O]$ ,  $Na_2GeF_6$ ,  $NaF$ , and  $K_2[Ge(IO_3)_6]$  in sodium nitrate-potassium nitrate melts was characterized. Acid-base titration of fluorogermanates with sodium carbonate or germanate revealed the formation of three new fluoro-oxo-germanate anions whose empirical compositions were determined from the titration curves. Figures 3; tables 2; references 7: (Western).

12765

**Physicochemical Study of Reaction of Beryllium with DNA**

18410204b Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian (manuscript received 13 May 86)  
Vol 61, No 10, Oct 87 pp 2749-2753

[Article by L.I. Tikhonova, Institute of Biological Physics, Moscow]

[Abstract] The investigation of the reaction of beryllium with DNA under different conditions included the use of methods such as stoichiometric titration, ion exchange, circular dichroism, and differential spectroscopy at pH 3.80-5.00 and at two ionic strength values ( $\mu = 0.01$  and  $0.165$  ( $\text{NaClO}_4$ )). Titration experiments showed that the reaction of  $\text{Be}^{2+}$  with DNA occurs within several seconds, while the nearer the ratio  $\text{Be}^{2+}:\text{DNA}$  approaches 1:2, the larger the volume of precipitate and the smaller that of the solution. One beryllium ion bonded to two available phosphate groups. Stability of the  $\text{BeA}_2$  compound was rather high and nearly equalled that of several protein complexes. Anticooperative combining of the phosphate residues of the polymer occurred at low concentrations of the cation and  $\mu = 0.165$ . At  $\mu = 0.01$ , DNA phosphate groups and purine bases combined with Be. The sodium ion ( $0.165$  mol/l) had a stabilizing effect on the polymer molecule by screening the base from association and protecting it from denaturation in the presence of Be. Figures 4; references 9: 6 Russian; 3 Western.

02791

**Atom, Molecule Relationship Theory Revised**

18410211c Moscow *IZVESTIYA* in Russian 5 Dec 87  
p 1

[TASS article: "Molecules as a Major Plan"]

[Text] On 3 December, a discovery made at Moscow State University by O. Reutov, academician, and L. Aslanov and V. Petrosyan, doctors of chemical sciences, in the field of coordination compound chemistry was recorded at the USSR State Committee for Inventions and Discoveries.

In many ways, it forces a re-examination of the theory of the reciprocal effect of atoms in molecules and a substantial change in the concept of what is known in scientific circles as "Chernyayev's trans-effect." Over 60 years ago, the Soviet scientist I. Chernyayev proved that the essence of the trans-effect is a weakening of bonds in compounds of transition metals and of elements in the large periods of the Periodic Table, beginning with scandium, yttrium, and lutetium, up to copper, silver, and gold, inclusive.

For a long time, this was considered to hold true for all metals, and even for all elements of the Mendeleyev Table. The authors of the present discovery, however, established the fact that in compounds of non-transition

metals, a directly opposite phenomenon is observed—a strengthening of the bonds. This also proved to be valid for a good half of the elements in the periodic system.

"By knowing the true essence of electron effects," says Professor V. Petrosyan, "new compounds with properties assigned in advance can be synthesized. Mathematical model study of the phenomenon makes it possible to switch an electronic computer into this work. The range of application of these compounds is extraordinarily varied. Let us take even tin compounds. Over 60,000 tons of them are produced in the world yearly. They are used as polymer stabilizers: after all, materials such as polystyrene, polyvinyl chloride, and others deteriorate rapidly, but adding tin compounds can considerably prolong their 'life.'"

"Organic tin compounds accelerate the synthesis of polyurethanes, which are used in industry, including consumer goods production, let us say, of footwear. They slow down the rotting process of wood. Pesticides for agricultural needs can be manufactured on the basis of these compounds. Special paints that prevent ship bottoms from being overgrown with barnacles and mollusks have been developed."

12151

**Molecular Structure of Calcium Thiocyanate Complex with Dibenzo-24-Crown-8 and Water Molecule**

18410152a Moscow *IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA* in Russian No 10, Oct 87 (manuscript received 19 Mar 86) pp 2225-2230

[Article by V.V. Tkachev, O.A. Rayevskiy, L.O. Atovm-yan, G.V. Shilov, V.Ye. Zubareva, and D.G. Batur; Institute of Chemical Physics, Chernogolovka Branch, USSR Academy of Sciences; Institute of Physiologically Active Substances, USSR Academy of Sciences, Chernogolovka; Institute of Chemistry, MSSR Academy of Sciences, Kishinev]

[Abstract] Study of the structure of complexes of inorganic cations with macrocyclic ligands, exhibiting ionophoric and other types of biological activity enhances clarification of the transport mechanism of the "metals of life" in biological systems. Calcium participates in life processes and has a special role. However, the lack of evidence on the structure of calcium salts of macrocyclic ligands makes it necessary to conduct a systematic and thorough study of these systems. Initial results in this area have been published previously. Study of the structure of metal salt complexes with macrocyclic ligands is also needed for solving problems in discerning chemical systems and modeling substrate-receptor complexes. From this viewpoint, complexes whose number of electron-donor sites exceeds the normal coordination number of the cation appear most interesting. Under these conditions, a metal ion is "compelled" to select partners from among donor atoms for reaction within the limits



of the internal coordination sphere. Results are presented in the present work on a study of the molecular structure of a crystal complex of calcium thiocyanate with dibenzo-24-crown-8 and a water molecule, using X-ray analysis and IR spectroscopy. An internal coordination sphere having seven electron-donor atoms was established in the complex. Of the eight oxygen atoms in the macrocycle, only four are included in coordination (two ethers and two anisoles). Figure 1; table 1; references 15: 6 Russian, 9 Western.

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**Formation of Double and Triple Complexes of Copper (II) with Enkephalin and Histidines**

18410152b Kiev TEORETICHESKAYA I  
EKSPERIMENTALNAYA KHIMIYA in Russian Vol  
23, No 5, Sep-Oct 87 (manuscript received 24 Nov 86)  
pp 634-641

[Article by K.B. Yatsimirskiy, V.A. Pokrovskiy, A.G. Kolchinskii, and V.V. Mosin, Institute of Physical Chemistry imeni L.V. Pisarzhevskiy, UkSSR Academy of Sciences, Kiev]

[Abstract] Interest has grown in the study of complex formation of biologically active peptides with metal ions due to the capability of peptide ligands to facilitate transport and accumulation of transition metal ions and to enhance the biological activity of certain peptide hormones in the presence of metal ions, due to stabilization of the active conformation of metal peptides or their resistance to hydrolysis with aminopeptidases. Metal complexes of oligopeptides may also be considered as models of certain metalloproteins. To study these complexes, methods are needed which require only small quantities, such as mass spectrometry. Field desorption and fast atom bombardment variants of mass spectrometry were used in the present work to study complex formation of transition metals with oligopeptides in solutions of varying pH, e.g., copper (II) enkephalinate. Specifically, the possibility of forming of a triple complex of copper (II) with enkephalin and histidine under near-physiological conditions was examined, since a fragment of the latter is probably attached to the active site of opiate receptors in the central nervous system and takes part in binding transition metal ions during neuropeptide reception. Formation of the triple complex at physiological pHs was confirmed. Since the biologically active form of enkephalin is an EK<sup>+</sup> anion, it may be assumed that during opiate receptor binding, both enkephalin and its complex with copper take part in positively charging a group on the protein chain at the active site of the receptor, probably the imidazole ring in the histidine. Figures 6; tables 2; references 20: 4 Russian, 16 Western.

12765

**Problems in Physical-Inorganic and Bio-Inorganic Chemistry**

18410151b Kiev TEORETICHESKAYA I  
EKSPERIMENTALNAYA KHIMIYA in Russian Vol  
23, No 5, Sep-Oct 87 (manuscript received 23 Jun 87)  
pp 529-545

[Article by Academician, UkSSR Academy of Sciences, K.B. Yatsimirskiy, Institute of Physical Chemistry imeni L.V. Pisarzhevskiy, UkSSR Academy of Sciences, Kiev]

[Abstract] Research in the narrow field between physical and inorganic chemistry has been conducted at the Institute of Physical Chemistry imeni L.V. Pisarzhevskiy, UkSSR Academy of Sciences, since its inception at the turn of the century. The main problems of inorganic chemistry centered about Mendeleyev's Periodic Law, and much work was done in this area, particularly with peroxides. Starting in 1970, the institute began intense research on the physical chemistry of coordination compounds. This included studies on their structure and properties, using X-ray and spectroscopic methods. Quantum-chemical studies were conducted to establish the relationship between the absorption spectra of coordination compounds and their structure and energy levels. Other studies included absorption and luminescence spectra of lanthanoids in the near IR, visible, and near ultraviolet regions to establish electron transitions in the 4f-electron shell. A special spectrographic method was developed to determine the composition and equilibrium constants of lanthanoids from spectral data. Research showed that lanthanoid complexes manifest a marked relationship between the nephelometric band shift in the spectra and the structure of the complex. This was used to study many lanthanoid coordination compounds with various ligands, such as solvent molecules, halide anions, and carboxylic and hydroxycarboxylic acids. Much research was conducted on the spectroscopy of 3d-transition element ions in ionic melts. High resolution nuclear magnetic resonance spectroscopy became a powerful tool for studying the structure of coordination compounds of metals with complex organic ligands. A promising variant of this method is NMR spectroscopy, employing lanthanoid shifting reagents. Lanthanoid ions, coordinating with substrate molecules, cause significant changes in the NMR spectra, i.e., a shifting and broadening of corresponding signals. This method was used to study metal complexes with many organophosphorus ligands and macrocyclic compounds. During the past 20 years, successful work was conducted on the thermodynamics of complex formation. Initially, the research centered on binary metal-ligand systems to form a single complex. As it developed, however, most cases showed that "step-wise complex formation" takes place, i.e., several coexisting complexes of varying composition form. From 1960-1970, a new science was born — that of bio-inorganic chemistry, also called inorganic biochemistry, depending on which side is emphasized. Metals combine with about 1000 proteins and play a key role by forming an active site in many enzymes. For this



reason, many biochemists feel that coordination chemistry must play a deciding role in examining processes in living systems. Macrocyclic coordination compounds have catalytic properties similar to metal-containing enzymes, such as cobalt with histidine. Complexes such as these with high catalytic activity are called "synzymes" (synthetic enzymes). The Institute of Physical Chemistry was the pioneer in bio-inorganic chemistry in the Soviet Union, since 1974, it has been coordi-

nating all research in this area in the USSR, and since 1981, by an Academy of Sciences plan, it has been coordinating all such work on bio-inorganic and bio-coordination chemistry with Bulgaria, the GDR, Poland, and Czechoslovakia. References 65: 58 Russian, 7 Western.

12765

**Synthesis and Study of Biological Activity of Aryl Ethers of 1-Oxymethyl Naphthalene**

18410074c Baku AZERBAIDZHANSKIY  
KHMICHESKIY ZHURNAL in Russian No 9, Sep 87  
pp 95-99

[Article by D.N. Khydyrov, A.A. Mamedova, F.R. Gadzhiev, S.M. Kafarova, Z.T. Efendiyeva, and S.B. Rzaeva, Institute of Petrochemical Processes imeni Yu.G. Mamedaliyev, AzSSR Academy of Sciences]

[Abstract] Derivatives of diaryl ethers are one of the most important groups of biologically active compounds. They include active herbicides and fungicides which are widely used as chemical agents for plant protection. Aryl ethers of aliphatic-aromatic alcohols, however, particularly 1-oxymethyl naphthalene, have not been well studied. In the present work, five such ethers were synthesized by a reaction of alkali metals with 1-chloromethyl naphthalene by a previously described method. Fungicidal and herbicidal properties were studied by standard methods, and the compounds were shown to be active, the most active being the 2,4-dichlorophenyl ether of 1-oxymethyl naphthalene. This compound is close to that of the standard, Zineb, in fungicidal activity against a number of diseases. The fungicidal and herbicidal activities of this compound were also established by experiments at the corresponding division of the All-Union Scientific Research Institute of Chemical Agents for Plant Protection, where it was demonstrated that at a 0.012% concentration, it suppresses development of powdery mildew in cucumbers.

12765

**After-Effects of Diazinon on Harmful and Useful Insects**

18410074a Moscow AGROKHIMIYA in Russian No 9,  
Sep 87 (manuscript received 29 Dec 86) pp 95-99

[Article by K.V. Novozhilov, V.N. Rozova, and N.F. Bakasova, All-Union Scientific Research Institute of Plant Protection, Leningrad]

[Abstract] Insects which survive non-lethal applications of pesticides may suffer other after-effects which affect the viability of both harmful and useful species. Effective use of insecticides against cabbage flies in the northwestern RSFSR is hampered by the prolonged period during which the flies are active and frequent rainfall, which lowers the effectiveness of the pesticide, requiring repeated sprayings which could harm other useful species of insects. An alternative is the use of pelletized preparations. In the present work, a study was made of the effect of pelletized diazinon (basudin) on the most harmful first generation of spring cabbage flies of two

species, *Delia brassicae* Bouche and *D. floralis* Fall, and the useful predator and parasite *Aleochara bilineata* Gyll. In field experiments, 10 m<sup>2</sup> plots were treated with 5% pelletized basudin at 50 kg/ha. Insects surviving the treatment were used in laboratory studies where it was determined that the pesticide is highly effective against the flies and that the residual quantities affect the daughter generation of the insects, increasing the fertility of the flies. Diazinon also has a stimulating effect on the aleochara. Tables 4; figure 1; references 7 (Russian).

12765

**Behavior of Synthetic Pyrethroids in Environment**

18410074b Moscow AGROKHIMIYA in Russian No 9,  
Sep 87 pp 109-131

[Article by N.N. Melnikov and N.I. Aronova]

[Abstract] Synthetic pyrethroids take second place in the scale of production and use of insecticides on a worldwide basis. In 1983, the world market comprised over 2,500 tons, used on a total area of 52 million hectares (including re-treating). The high physiological activity, broad spectrum of application, and the ever-increasing scale of production and use of these compounds made it necessary to study their fate in various parts of the environment to ascertain the safety in using them and the possibility of negative after-effects. Significant progress was made possible only in recent years when substances with radioactive tracers on various parts of the molecule became available. Although much material has been accumulated on the synthesis, toxicology, and photochemical breakdown of pyrethroids, new data keeps appearing, which on the one hand confirms the safety of pyrethroids to living organisms with proper application, and on the other hand warns of maintaining a careful approach to widespread application, since certain species of insects resistant to chloroorganic and organophosphorus preparations were found to have a cross-resistance to pyrethroids which were not previously used against these insects. The present review on the behavior of synthetic pyrethroids is confined to those preparations which are now being widely used in agriculture. The review covers the structure of pyrethroids, their metabolism in living organisms, soil, and water, and their behavior in plants. While synthetic pyrethroids are readily decomposed in the environment and low norms of application make it possible to minimize or completely circumvent environmental pollution, certain degradation products could be more persistent than the initial product, making careful study of their behavior imperative. At the present time, there is only a very limited amount of information on the behavior of pyrethroids in water systems, so that application of these compounds near rivers, lakes, and seas should be done with this in mind. Figures 16; tables 2; references 103; 8 Russian, 95 Western.

12765

**Liquid Fuel from Coal and Carbon Monoxide**  
18410253 Moscow *ADVANCES OF SCIENCE AND TECHNOLOGY* in English No 1, 5 Jan 88, item 5

[Article by Revmira Voshenko, Novosti correspondent]

[Text] The search for the most efficient methods of producing liquid fuel from coal is underway in the USSR and other countries. An original solution has been found by scientists from the Institute of Organic Synthesis and Coal Chemistry, Kazakh Academy of Sciences.

"The new technology solves two problems—production of liquid fuel from coal and oil refining residues and the ecological," the Institute's director, Prof. Murat Zhurinov, says. "Our Institute is in Karaganda in the center of a major Soviet coal field. The nearby large ferroalloy and phosphorus plants and oil refineries pollute the environment with slag and noxious gases, particularly carbon monoxide. Our technology of producing liquid fuel from coal and oil refining residues, such as tar, is appreciably better than the existing ones."

Bolat Ermagambetov, Candidate of Chemistry, who heads the Coal Chemistry Laboratory, shows me a small unit and says that "it is a scaled-down model of the plant which can be created on the basis of existing steel-making, oil-refining, and coal-producing plants and without much investment. Coal or tar and an iron-containing catalyst—slag—are charged into the reactor.

Then carbon monoxide is fed there under a pressure of 40 atmospheres, and the mixture is heated up to 400 degrees Centigrade. The hydrogenation process takes one hour: the oxide gives off active hydrogen, which reacts with the organic components of carbon and tar. In this way, liquid fractions are produced—fuel for automobiles and tractors and raw materials for the production of lubricants and chemicals." This technology has been tested by the Moscow Institute of Fossil Fuels and found efficient.

"Based upon the long-known method of producing liquid fuel from hydrogen-saturated coal, we've greatly simplified and updated it and made it cheaper," Prof. Zhurinov continues. "In other countries, pure or molecular hydrogen was used, for whose production and storage special plants and tanks have to be built. According to our practice, the carbon monoxide contained in industrial waste gases releases such hydrogen during the reaction. Our hydrogenation process is much more efficient and occurs at a lower temperature and pressure. The environment becomes healthier because, besides carbon monoxide, compounds of vanadium, nickel, etc., are removed from the waste gas and deposited on the iron-containing catalyst. In comparison with the molybdenum and platinum catalysts used in the West, our catalyst is readily available, low-cost, and reclaims rare metals at that."

79604

**Features of Structure Formation and Properties of Thermoplastic Rubbers, Produced by Dynamic Vulcanization**

18410198c Moscow KAUCHUK I REZINA in Russian No 11, Nov 87, pp 14-18

[Article by A.A. Dontsov, M.A. Yumashev, A.A. Kanauzova, and B.I. Revyakini]

[Abstract] Composite materials based on a combination of rubbers and thermoplastic materials, obtained by dynamic vulcanization, combine the properties of vulcanized rubbers during use and exhibit high thermoplasticity at high temperatures. These materials, called dynamic thermoelastoplastic materials (DTEP), have the capacity, like other thermoelastoplastic materials, to be reworked many times without losing their physical-mechanical properties. They are used to intensify technical properties in the production of commercial rubber products. DTEPs are considered to be two-phase mechanical mixtures in which cross-linked particles of rubber with  $\mu\text{m}$  dimensions are dispersed in the continuous phase. The structure and properties of elastomer/thermoplastic material with a high complex of physical-mechanical properties and with components similar in solubility parameters but differing in degree of crystallinity, viscosity, and chemical nature of the polymers were studied to confirm the conditions for producing and reworking DTEP. The vital importance of the boundary layer in this process was explained and discussed. The connection between the reproducibility of DTEP properties and the boundary layer structure was described. Figures 6; references 12: 8 Russian; 4 Western.

02791

**Extrusion Conversion of Composite Materials Based on Ground Wood and Thermoplastic Materials**

18410198b Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 87, pp 42-44

[Article by V.A. Belyy, B.I. Kupchinov, V.G. Barsukov, and V.M. Shapovalov]

[Abstract] Use of wood and polymer wastes and the introduction of progressive methods of their conversion have increased the effectiveness of production and economized on scarce raw material and intermediates, but production of distillate products from wood polymers by traditional technologies involves significant shortcomings, including the batch nature of the cycle, which impedes mechanization and automation of production, the complexity and bulkiness of equipment, and the low productivity of the process. A screw extrusion method is most promising. This article describes principles of processing ground wood and thermoplastic materials into distillate products by this method. The study produced data which can be used to create composite materials

based on wood and thermoplastic material and a technological process and equipment for producing distillate products. The technological process was described and discussed briefly. Savings from introducing this technology on two extrusion lines was 46,400 rubles. Expansion of production will save more than 400,000 rubles, 8600  $\text{m}^3$  of commercial timber, and 760 tons of polyvinyl chloride. Figures 2; references 6: 3 Russian; 1 Western.

02791

**Iodine-Containing Films Based on Vinyl Alcohol Polymers**

18410198a Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 87, pp 19-20

[Article by V.Ya. Bogomolnyy, F.O. Pozdnyakova, and M.E. Rozenberg]

[Abstract] Complexes of iodine with polyvinyl alcohol (PVA) and polyvinyl pyrrolidone (PVP) are now being used extensively in medicine. These iodine complexes have good antiseptic, anti-viral, and fungicidal properties, and the iodine does not produce a general toxic nor "burning" effect. The PVA-iodine complex has a spiral-form structure, with 12 PVA units per loop, and the iodine molecules are situated inside the spiral cavity. This article described development of film compositions, based on iodine complexes with PVA and vinyl alcohol, vinylpyrrolidone, and vinyl formal polymers, by single-stage molding from iodine-containing aqueous solutions of vinyl alcohol polymers at a temperature higher than the temperature of formation of the blue iodine-PVA complex (50-60° C). Study of the rate of iodine liberation from the films under model conditions involved immersing 6  $\text{cm}^2$  film samples in 50 ml of a physiological or citrate-buffer solution, maintaining them at 20 or 40° C, titrating them with a 0.1 N solution of thiosulfate after designated periods of time, and determining the residual iodine level. Iodine was liberated most rapidly in the first day; by the third day, its level was 30%. These findings confirmed the favorable prospects for using iodine-containing films as antimicrobial dressing material during treatment of diseases associated with skin injuries. References 9: 8 Russian; 1 Western.

02791

**Polymer Materials in Agricultural Production**

18410200b Moscow KHIMIYA V SELSKOM KHOZYAYSTVE in Russian No 11, Nov 87 pp 43-44

[Article by V.N. Smirnov and N.G. Samsonov, State Agricultural Industry, RSFSR]

[Abstract] RSFSR agriculture used no more than 40% of the polymer material available to it in 1987. Most of it was used in the form of film. Use of such film in vegetable growing made it possible to create fundamentally new designs of greenhouses which reduced capital



expenditures 4-5-fold and halved labor expenditure in comparison with previous costs of glass greenhouses. Use of polymer film in fodder production ensured great savings. Vegetables and fruit could be stored 2-3 months longer than usual with the use of polymer packaging. Use of polyethylene containers for shipping mineral fertilizers began in 1984. Protection of soil from wind and water erosion by the use of polymer materials was discussed. Seed dressing with the use of water-soluble polymers improved sanitation and hygiene conditions, increased seed germination, reduced plant deaths, and increased grain yields. Use of polymer materials for rapid construction of light metal structures provided large savings. The RSFSR State Agroindustry is introducing polymers into agroindustrial production via the "Polymer" program, which is scheduled to run until 2005. This program will replace 150,000 tons of metal pipes with plastic pipes in rural domestic construction.

02791

**Study of Stability While Heating Galvanoplastic Metal-Fiber Glass Bi-Materials**

18410211d Vilnius TRUDY AKADEMII NAUK  
LITOVSKOY SSR: SERIYA B in Russian No 4,  
Jul-Aug 87 p 137

[Abstract of a deposited article by R.A. Glyamzha and A.P. Mikalauskayte, Chemistry and Chemical Technology Institute of the LiSSR Academy of Sciences, Vilnius, 1986, 14 pages, 11 illustrations, 12 bibliographical entries. (Manuscript deposited at the Lithuanian Scientific Research Institute of Scientific-Technical Information and Technical-Economic Research (LitNIINTI), 14 February 1986, No 1576 Li-D 86): "Study of Stability While Heating Galvanoplastic Metal-Fiber Glass Bi-Materials"]

[Text] The equation for the stability of a bi-metallic plate is used as a mathematical model to predict stability in the operation of two-layered structures (DK), made by means of a combined galvanoplastic method and consisting of a thin layer (0.1 mm) of Cu or Ni electroplating and a layer of epoxy fiber glass from 1.2 to 8.5 mm thick.

It was shown that the data obtained on the flexure of the DK is less than the calculated values, but the direct relationship of the flexure to the operating temperature and inverse thickness of the plastic layer is maintained, which makes it possible to calculate in advance the flexure of the DK with a change in the environmental temperature and in the thickness of the items with the introduction of empirical correction factors, taking into consideration the specific properties of the plastic layer.

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Seriya B, 1987

12151

**Applications of Cholesteric Materials in Flaw Detection, Radar**

18410243c Moscow SOTSIALISTICHESKAYA  
INDUSTRIYA in Russian 14 Jan 88 p 4

[Article by A. Abakumov]

[Excerpt] The laboratory of liquid-crystal materials at the "Monokristallreaktiv" (mono-crystal reagent) Research and Production Association in Kharkov has developed its own original process for obtaining cholesterol.

"A program for research of cholesteric liquid crystals has now been practically completed," said Candidate of Chemical Sciences B. Distanov, head of this laboratory. "A chemical-reagents plant which is part of our association has organized production of indicators of the most diverse kinds—not only ones which operate millions of times without deteriorating but also ones which change only once. A process has been mastered for producing temperature-indicator films and pastes, and in the future we hope to produce aerosols as well."

"Cholesteric materials respond well to ultrasound," said Candidate of Chemical Sciences V. Tishchenko, head of a sector of the laboratory. "Consequently, work can now begin on development of ultrasonic holographic 'X-ray' equipment which will show internal organs in color and in three dimensions."

"Cholesterics can also be used as flaw detectors," added Distanov. "Laboratory specimens easily spot faults in printed circuit boards and detect hollows and cavities in forgings, castings and welds, as well as defective adhesive joints and soldering. The temperature of rotating parts is recorded well by these materials."

Thanks to extensive theoretical investigation of cholesterol-like structures, methods have been learned here for transforming many organic compounds which do not contain cholesterol. This makes it possible to develop effective high-speed optical shutters. That they may become basic structural components of new-generation optical computers with high speeds is not out of the question.

Basic theory makes it possible to design liquid-crystal indicators with prescribed properties. As is known, the safety of civil-aviation operations depends on precise adjustment of radar antennas. It is also known that such adjusting work is very complex from the technical standpoint. An indicator film which has been developed in the laboratory and responds well to microwave radiation of radar equipment will make it possible to simplify this work and lower its cost. Varieties of this film can be used to measure temperatures of distant stars—with the aid of a telescope, of course—and to tune powerful infrared lasers.

/9738

**Quenching Medium, Hemostatic Agent Developed at Chemistry Institute**

18410243b Moscow KRASNAYA ZVEZDA in Russian  
31 Jan 88 p 4

[Article by A. Batalin (Irkutsk)]

[Excerpt] M. Voronkov, director of the Institute of Organic Chemistry of the USSR Academy of Sciences' Siberian Branch, related:

"Our principle is to obtain results which have no counterparts in world practice.

"Scientists of the institute have developed a versatile aqueous solution of a polymer for hardening metals. As compared with similar media that were previously known, this new quenching medium is superior in terms of many parameters: quality of metal, service life, range of working temperatures, and capability of hardening products of all sizes and shapes made of different brands of steel. Salvaging waste liquid involves no problems; it is ecologically harmless.

"A preparation called ferakril is a hemostatic agent with local action. It successfully combines hemostatic action with an anesthetic effect. An organ which is being operated on is treated by the surgeons with ferakril, and the operation continues 'dryly', as medical personnel say. Ferakril is effective both when the blood-coagulating system is in normal condition and in cases of pathological impairment of this system. Substantial reduction of blood loss and operating time, savings of donor blood and bandaging materials, facilitation of the work of surgeons—these are among the features of ferakril.

"This preparation not only can be broadly employed in all fields of surgical practice but can also be used in treatment of injuries and burns occurring in industry, sports and the home."

/9738

**Carbon-Based Composite Materials R&D at Graphite Institute**

18410243a Moscow MOSKOVSKAYA PRAVDA in Russian 11 Feb 88 p 1

[Article by S. Turanov]

[Excerpt] Research has demonstrated that fibers made of carbon are approximately twice as strong as ones made of steel. This factor, plus enormous reserves of this natural raw material, have become the reasons for employment of carbon-based composite materials on a high-priority basis. The Scientific Research Institute of Graphite (Nilgrafit) of the USSR Ministry of Nonferrous Metallurgy (Mintsvetmet) is one of the leading organizations for research, development, and industrial introduction of these materials in our country.

"The use of many composite materials which our institute has developed on the basis of carbon leads to savings of scarce metals," said Professor V. Kostikov, director of Nilgrafit. "Epan, a material based on a polymer matrix, combines good antifriction properties with high resistance to chemical reagents, for example. It resists sulfuric and hydrofluoric acid and even aqua regia. Use of a single kilogram of epan in centrifugal pumps results in savings of 150 kilograms of stainless steel or 50 kilograms of titanium.

"Development of a number of types of modern transport equipment is inconceivable without friction components that we have developed. A cermet which was used previously for these purposes has not withstood tests. In the giant new AN-124 transport airplane, for example, it 'grabs' under excessive loads and jams the braking mechanism. Carbon composites 'operate' well in these conditions. Employment of friction composites reduces the weight of the AN-124 by 3 tons, for example, which results in savings of about 3,000 tons of fuel during the period of operation."

USSR Mintsvetmet and the USSR Ministry of the Chemical Industry (Minkhimprom) are competing firms in production of carbon composites. But the chemical industry has a big advantage: it produces the raw materials. Therefore, it naturally allocates them to other industries only after meeting its own requirements.

"We are working with USSR Minkhimprom in this one direction, but we have no contact with its enterprises," complained V. Kulakov, head of a sector of Nilgrafit. "This leads to needless expenditures for scientific developments which duplicate each other. Such competition hurts the economy, in my opinion."

/9738

**Features of Coating Polystyrene with Metal**

18410146b Ivanovo IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA TEKHOLOGIYA in Russian Vol 30, No 9, Sep 87 (manuscript received 24 Jul 85) pp 67-70

[Article by Ye.V. Boyarskaya, G.A. Korchinskiy, V.S. Osadchik, and A.F. Sergiyenko, Vinnits Polytechnic Institute]

[Abstract] A study was conducted on producing copper coatings on polystyrene and on means for increasing the adhesion of metal films to the polymer and decreasing internal stress. The first conducting layer was deposited with a vacuum thermal spray with reduction of surface copper from a chemical copper plating solution. Transient electrolysis was used for galvanic thickening of the deposited copper layer. Plasmochemical purification in a low-temperature plasma and chemical etching with sulfuric acid and chromic oxide at 55° C or sulfurization in anhydrous and 20

fuming sulfuric acid were used for preliminary treatment of the polystyrene surface. Measurement of the dielectric potential during copper deposition showed a sharp shift in the cathodic direction, with the time of this shift depending on formaldehyde concentration in the plating solution. The shift was connected with the adsorption of formate and hydrogen onto the surface, which is necessary for electrochemical copper reduction. When copper reduction was conducted in solutions containing sodium potassium tartrate, glycerin, or complexone III, copper deposition was fastest with tartrate and slowest with glycerin. Hydrogen reduction yielded coatings of poor quality. Adhesion was best with glycerin and unsatisfactory with complexone III. The recommended conditions are: 1) chemical etching in chromic oxide and sulfuric acid at 55° C for 30 minutes or plasmochemical purification in oxygen for 10-20 minutes; 2) sensitization in stannous chloride and hydrochloric acid solution for 3 hours at room temperature; 3) activation in palladous chloride and hydrochloric acid solution for 1 minute; 4) chemical copper deposition in a solution of copper sulfate, nickel sulfate, sodium potassium tartrate, sodium bisulfate, sodium hydroxide, and formaldehyde at pH 12.4-12.6, 25° C, with continuous stirring, for 5-10 minutes; 5) electrochemical copper film growth in sulfuric acid and copper sulfate electrolyte containing ethanol with nonsteady state electrolysis. This method made it possible to prepare flexible metal-coated polystyrene samples which satisfy contemporary lithographic requirements. Figures 2; references 6 (Russian).

12126

**Kinetic Rules for Radiation-Induced Graft Polymerization of Vinylidene Chloride from Gas Phase onto Polypropylene Fibers**

18410146a Moscow VYSOKOMOLEKULYARNYYE SOYEDNENIYA in Russian Vol 29, No 10, Oct 87 (manuscript received 30 Apr 86) pp 2128-2131

[Article by A.A. Snimshchikova, A.V. Vlasov, V.A. Lvov, and B.L. Tsetlin, Central Scientific Research Institute of the Cotton Industry]

[Abstract] The kinetics of X-ray-induced vacuum graft polymerization of vinylidene chloride onto polypropylene fibers were studied. The rates of polymerization onto a polypropylene support and onto previously-grafted vinylidene chloride were found to be independent and additive. Kinetic curves calculated by choosing the rates of the two processes to be as close as possible to each other corresponded well with experimental data. The dependence of the two rates on X-ray dose intensity indicated that the reaction occurs in the kinetic region without a diffusion lag. Conducting the polymerization with polyvinyl chloride powder demonstrated that the rate of vinylidene chloride polymerization on grafted polyvinylidene chloride proceeds with the same rate as on a "free" polymer. Rates of grafting were linearly dependent on vinylidene chloride vapor pressure. The

temperature coefficients observed were small and negative, due to decreased vinylidene chloride vapor sorption at elevated temperatures. For polymerization on a polypropylene support, the reaction is close to first order, while for polymerization onto previously-polymerized vinylidene chloride, the reaction order is 2.0-2.7, depending on sorption values. The results obtained make it possible to calculate the kinetic curves for any given reaction parameters. Figures 4; references 6: (Russian).

12126

**Polyurethane Bonding Agents For Magnetic Recording Tape Media**

18410090c Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 87 pp 35-37

[Article by V.P. Kuznetsova, S.I. Omelchenko, O.I. Babich, and O.G. Shablina]

[Abstract] Polyurethanes, which are highly wear resistant and which combine hardness with elasticity and high strength with good adhesion to different materials, have been used most extensively as bonding agents of magnetic tape media. Film-forming polyurethanes with various structures and properties may be obtained by changing the ratio of isocyanate- to hydroxyl-containing starting compounds and their hardening conditions. Magnetic recording tape media with a highly resistant working layer and good physical-mechanical and acoustic properties, which must be used in complex climatic conditions, are prepared from polyurethane bonding agents for ferromagnetic suspensions. These facts created an interest in studying the feasibility of creating polyurethane bonding agents for magnetic recording tape media with high wear resistance and reliability. A high molecular weight ternary copolymer, vinylchloride + vinylacetate + vinyl alcohol (type A-15-OM) and trimethylol propane were used as hydroxyl-containing components in the bonding agent. Use of a ternary copolymer ensures preparation of varnishes with good fluidity and stable viscosity. The isocyanate component was a mixture of low-toxicity polyisocyanates, an adduct of tolylene diisocyanate and trimethylol propane (triisocyanate TT-75) and synthetic molding rubber type SKUPFL-100. We determined the optimum ratio of SKUPFL-100:triisocyanate TT-75 during production of a polyurethane bonding agent for a magnetic recording tape medium by mathematically designing an experiment. Analysis of microhardness and adhesive and triboadhesive properties of the working layer of series-produced magnetic recording tape media without impregnation or impregnated with polymer solutions of varying concentration showed that increasing the polymer level in the impregnating solution decreased the adhesive interaction of the tape medium, while the tape medium's resistance to friction loads increased. After



impregnation, electromagnetic properties of the magnetic recording tape medium changed insignificantly, making it possible to use them in magnetic recording equipment. Figures 2; references: 19 Russian.

02791

**Effect of Flow Rate with Combined Effect of Pliable Surface and Polymer Additives on Turbulent Friction**

18410090d Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA TEKHNICHESKIYE NAUKI in Russian (manuscript received 10 Jan 86) Vol 15, No 4, Jul-Aug 87 pp 42-46

[Article by V.M. Kulik, I.S. Poguda, B.N. Semenov, and T.I. Yushmanova; Institute of Thermophysics, Siberian Department of the USSR Academy of Sciences, Novosibirsk; Institute of Organic Chemistry, Siberian Department of the USSR Academy of Sciences, Irkutsk]

[Abstract] This paper describes a continuation of studies begun by B.N. Semonov, et al., entitled "Combined Effect of Small Polymer Additions in a Flow and Compliance of the Surface to Turbulent Friction." Solutions of polyethylene oxide with molecular weights  $M = 3.5 \times 10^6$  and  $4.7 \times 10^6$  were used as high molecular weight additives while the water temperature was varied from 6.5 to 17° C. Deviations from additivity  $\Delta = \Psi_{12}/(\Psi_1 + \Psi_2) - 1$ , where  $\Psi_1$  is the change in friction on the damping wall without polymer additions,  $\Psi_2$  is the reduction in friction brought about by the polymer additives, measured on a solid, hydraulically smooth surface, and  $\Psi_{12}$  is the effectiveness of the combined effect. Experiments showed that in a varying flow rate, the combined effect has an extremely complex and ambiguous nature. Different regimes produced a combined effectiveness which could be either greater or lesser than the effectiveness of an individual effect. Figures 3; references 12: 10 Russian; 2 Western.

02791

**Status and Prospects of NPO "Polimersintez"**

18410090a Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 87 pp 3-5

[Article by N.V. Kiya-Oglu]

[Abstract] The Scientific Production Association (NPO) "Polimersintez," founded on the basis of the All-Union Order of the Red Banner Scientific Research Institute of Synthetic Resins, celebrated 30 years of operation in 1987. The "Polimersintez" NPO and the MNTK (Interbranch Scientific and Technical Complex) "Membrana" include 5 major subdivisions: a scientific section (head institute — Scientific Research Institute of Synthetic Resins), the design section (the former Vladimir branch of Giproplast), an experimental plant, an experimental-production base, and the Vladimir Chemical Plant for series production. The MNTK "Membrana" includes 30

organizations of different ministries, which provide a collective solution to the task, beginning with research work and ending with the introduction of membrane technology for separating substances to various sectors of the national economy. The creation of 3 computer centers at "Polimersintez" is quite important. This provided for mathematical modelling of technological processes, processing of experimental data, quantum-chemical, and economic calculations with the use of YeS-1061 and YeS-1045 computers, and operation of an automatic control system for major experimental apparatus. The primary work of "Polimersintez" involves producing polyurethane materials. Increases in production during the 11th Five-Year Plan and during the life of the organization are described and discussed. Major products include alkylene oxide oligomers, ester oligomers, and cellulose esters and ethers. Development of large-tonnage production of liquid phenol oligomers and production of catalytic systems for hardening them are described. Achievements made in each of the 5 major subdivisions are recounted and described briefly. Some areas of under-achievement are mentioned and discussed as well.

02791

**Synthesis and Some Properties of Arsenic-Containing Polyethers**

18410091 Tbilisi SOOBSHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian (manuscript received 31 Jan 86) Vol 127, No 2, Aug 87 pp 289-292

[Article by T.M. Gogiashvili, T.Z. Alavidze, R.D. Gigauri, and V.A. Vasnev, Tbilisi State University]

[Abstract] It may be assumed that introducing arsenic into macromolecules will give polymers refractoriness, biological (bactericidal, fungicidal) activity, biostability and some other valuable qualities. The article described and discussed synthesis and some properties of previously undescribed arsenic-containing polyethers. Polymers were produced by low-temperature polycondensation of phenyl(methyl)dichloroarsines with bisphenols in an organic solvent in the presence of triethylamine. Composition and structure of the polyethers produced were confirmed by chemical analysis and IR spectroscopy. Dynamic thermogravimetric analysis in air showed that the heat resistance of arsenic-containing polymers is rather high, is only slightly dependent on the structure of the initial bisphenol, and is in the 340-350° C range. Study of the thermomechanical curves of the arsenic-containing polyethers, synthesized on the basis of phenyldichloroarsine with dimethyl diene and diene showed that their heat resistance is in the 250-270° C range. X-ray crystallographic analysis showed these polymers to have a crystalline structure. The synthesized arsenic-containing polyethers have high bactericidal activity. An example of polycondensation was presented. 1.115 g (0.0674 ml (0.005 mole)) phenyldichloroarsine were added to a solution of 1.140 g (0.005 mole) diene

and 1.40 ml (0.010 moles) triethylamine in 25 ml acetone at 30° C over 1-2 seconds. After 1 hour, the precipitated polymer was filtered and washed with distilled water, chlorine ions were removed from the sample with silver nitrate and then acetone, and it was dried in a vacuum-desiccator over phosphorus pentoxide and paraffin until it reached a constant weight. A polyether with a yield of 1.3 g (70%) and  $\eta_{sp} = 12$  l/kg was obtained. Figures 2; references: 6 Russian.

02791

**Bioreistance of Epoxy Polymers**

18410090b Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 87 pp 19-21

[Article by V.F. Stroganov, V.M. Mikhalechuk, Yu.S. Zaytsev, N.A. Bichurina, and O.G. Bobrov]

[Abstract] A study of the effect of the nature of the hardening agent on resistance of epoxy polymers to the effect of aqueous carboxylic acid solutions (the most

aggressive metabolites of saprophytic fungi) was described and discussed. Polymers based on epoxydiane oligomer type ED-22, hardened by isomethyl tetrahydrophalic anhydride (iso-MTHPA), a homopolymerization catalyst, a complex of boron trifluoride and benzylamine (UP-605/3r), amine hardeners UP 0633, 1,3-bis(amino-methyl)adamantane (DAMAD), and oligourethane diamine were the object of study. Polymer samples were kept in 0.01 molar aqueous solutions of fumaric acid, citric acid, oxalic acid, and tartaric acid and in distilled water at 20 plus or minus 2° C, weighed on an analytical balance, and their dielectric and thermomechanical properties were studied. It was found that the resistance of epoxypolymers to the effect of carboxylic acid solutions and microorganisms under conditions approximating natural conditions depends upon the nature of the hardening agent, which determines the chemical and topological structure of the epoxy polymers. References: 9 Russian.

02791

**Enthalpy of Formation of Gaseous Uranium Pentafluoride**

18410204a Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian (manuscript received 20 May 86)  
Vol 61, No 10, Oct 87 pp 2593-2598

[Article by A.A. Bondarenko, M.V. Korobov, L.N. Sidorov, and N.M. Karasev, Department of Chemistry, Moscow State University imeni M.V. Lomonosov]

[Abstract] Recently, the chemistry of uranium compounds, including uranium fluorides, has interested researchers in connection with the use of these compounds in nuclear power engineering. This article describes the determination of the enthalpy of formation of gaseous pentafluoride. It has been found that data in the literature on uranium are somewhat contradictory. Two research groups (Stanford Research Institute (USA) and the Moscow State University Department of Chemistry (USSR)) are now conducting systematic studies to determine the enthalpy of formation of gaseous fluorides by a high-temperature mass-spectrometric method with the use of a heterogeneous source for the molecular beam. Since the Stanford group has published data on the studying gaseous uranium fluorides and determining the enthalpy of formation of  $UF_6$ , this study explored the possibility of directly comparing results from using the same methodological approach on different experimental devices. The Soviet studies used the Soviet magnetic mass-spectrometer MI-1201. The Stanford group and the Soviet group, using different experimental devices and different fluorinating agents ( $UF_6$  and  $F_2$ , respectively) independently obtained similar data on equilibrium, signifying the reliability of the experimental methods of both experimental groups. The enthalpy of dissociation  $D_0^\circ$  determined by D.L. Hildenbrand and that determined in this study differed significantly. These differences were presented, and sources of possible error were given and discussed in considerable detail. References 5: 1 Russian; 4 Western.

02791

**Luminescent Properties of Copper in Aluminophosphate Glasses**

18410197b Leningrad *FIZIKA I KHIMIYA STEKLA* in Russian (manuscript received 22 Dec 86) Vol 13, No 6, Nov-Dec 87 pp 860-865

[Article by S.A. Postelnikov, Institute of Biophysics, Moscow]

[Abstract] Copper-activated glasses are known to be intensely luminescent materials which are promising for use as thermoluminescent ionizing radiation detectors, radioluminophors, and converters of ultraviolet light into visible luminescence. In view of this, this work was performed in order to study luminescent properties of

copper in many aluminum phosphate glasses with special attention being given to ambiguities in the appearance of blue and yellow luminescence bands. The excitation spectrum of yellow luminescence consisted of 3 bands in the 300 nm, 325 nm, and 360 nm regions. The form of excitation spectra and photoluminescence of yellow luminescence did not change, regardless of conditions of reduction and concentration of copper. Yellow luminescence did not occur under neutral conditions, but a more rigid reduction regime helped to increase the intensity of this band. The relative intensity of the yellow band in relation to the blue band decreased rapidly with an increase in the copper level in the glass. The blue luminescence excitation band shifted into the long-wave region with increased copper concentration, the photoluminescence spectrum shifted into the long-wave region, and the half-width of the photoluminescence band increased. In all glasses studied, the yellow luminescence intensity did not exceed one third of the blue luminescence intensity. It was assumed that introduction of  $Cu^+$  into aluminum phosphate glass creates two different types of luminescent centers. Blue luminescence is typical of isolated  $Cu^+$ , and yellow luminescence is typical of  $Cu^+$  ions together with oxygen vacancies. Increased copper concentration in the glass increased the percentage of blue luminescent centers. Yellow luminescence disappeared when the glass was synthesized under neutral conditions and when alkali modifiers were introduced into the glass. Yellow luminescence was not observed in thermoluminescence spectra. Figures 5; references 8 (Russian).

02791

**Mathematical Model of Accumulation and Decomposition of Molecular Products During Radiolysis of Water**

18410117 Moscow *DOKLADY AKADEMII NAUK SSSR* in Russian Vol 296, No 6, Oct 87 (manuscript received 16 Feb 87) pp 1388-1392

[Article by A.V. Gordeyev, S.A. Kabakchi, B.G. Yershov, V.L. Grishkin, and V.L. Bugayenko, presented by Academician V.I. Spitsyn, 24 Nov 86; Institute of Physical Chemistry, USSR Academy of Sciences; Institute of Theoretical and Experimental Physics, Moscow]

[Abstract] The purpose of this work was to create a mathematical model of accumulation and decomposition of molecular products of water radiolysis and to define a matched set of reaction rate constants suitable for describing the data obtained with the broadest possible variation of experimental conditions in neutral water. Calculations were performed using the KINETIC software package, developed by two of the authors and published in 1981. A table lists the 28 reactions assumed to be included in the mechanism of radiolysis. The set of matched reaction rate constants is sought by varying the constants within the limits of divergence of the experimental values of the constants presented in a previous



work. The set of constants which describes the experimental data with the minimum mean square deviation is considered optimal. The kinetics of hydrogen peroxide decomposition in neutral water at room temperature under  $\gamma$ -irradiation are studied for varying hydrogen peroxide and molecular hydrogen concentrations. The studies indicated that the reaction scheme used in the work with a matched set of rate constants can describe the data found in the literature on accumulation and decomposition of  $H_2O_2$ ,  $H_2$ , and  $O_2$  during radiolysis of water. Figures 4, references 10.

06508

**Stabilized Forms of Tritium in Lithium Salts with Complex Oxygen-Containing Anions**

18410176b Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 61, No 11, Nov 87 (manuscript received 25 Dec 86) pp 3093-3098

[Article by L.N. Kurilenko, N.V. Serebryakova, Ye.I. Saunin, V.V. Gromov, and N.P. Sokolova, Institute of Physical Chemistry, USSR Academy of Sciences, Moscow]

[Abstract] Although study of stabilized forms of tritium in inorganic compounds is of considerable scientific interest, little work using IR spectroscopy has been done. In the present work, IR spectroscopy was used to study stabilized forms of tritium, generated from nuclear reactions. Stabilized forms of hot tritium in poly- and single crystals of  $LiAlO_2$ ,  $Li_2MoO_4$ , and  $Li_2WO_4$  were studied. Two types of tritium-containing fragments are present:  $OT^-$ , coordinated at the metal atom matrix and responsible for absorption in the 2300-1800  $cm^{-1}$  region, and another absorbing in the 1650-1000  $cm^{-1}$  region. The role of impurities, radiation defects, structure, and surface are discussed. Figures 3; tables 3; references 11; 4 Russian, 7 Western.

12765

**Gas Chromatography Used to Study Selective Adsorption of Mixtures of Hydrogen Isotopes with High Degrees of Filling**

18410176a Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 61, No 11, Nov 87 (manuscript received 14 Oct 86) pp 3077-3078

[Article by V.S. Parbuzin, Yu.A. Leshchev, A.A. Lukyanov, and K.D. Shcherbakova, Moscow State University imeni M.V. Lomonosov, Chemistry Department]

[Abstract] Determination of the thermodynamic adsorption characteristics of hydrogen isotopes is interesting both from the standpoint of developing adsorption methods for their separation and for constructing theoretical models of adsorption. The selectivity of hydrogen isotope adsorption has been studied under static and dynamic conditions with moderate and high degrees of filling and with gas chromatography with very low or "null" degrees of filling. In the present work, gas chromatography was used to study the adsorption selectivity of hydrogen isotopes and nuclear-spin isomers with high degrees of filling on silica gel. High degrees of filling were achieved by using one of the components of the mixture, hydrogen or deuterium, as the carrier gas. Chromatography of the stable components was conducted on a LUCH-2 chromatograph, and that of the tritium-containing components on a radiochromatograph. The hydrogen used had an ortho-para composition that was in equilibrium at liquid nitrogen temperature. Isotopes and isomers were separated in a 2.7 m x 3 mm diameter spiral-shaped column, filled with air-dried silica gel. The mixture of para- and ortho-hydrogen, para- and ortho-deuterium, and HD was eluted with neon, hydrogen, and deuterium. Separation of ortho- and para-deuterium, and especially ortho-hydrogen and HD, was not complete. The parameters for chromatographic separation of the isotopes and isomers at 52-57 K were determined. Tables 2; references 5: 2 Russian, 3 Western.

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**Obituary of V.I. Spitsyn**

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[Excerpt] Soviet science has suffered a grave loss. Academician Viktor Ivanovich Spitsyn, an outstanding scientist in the fields of inorganic chemistry, radiochemistry, and physical chemistry, died on January 30, 1988. He was honorary director of the USSR Academy of Sciences' Institute of Physical Chemistry, head of the chair of inorganic chemistry of the chemistry school of Moscow State University (MGU), a Hero of Socialist Labor, and a USSR State Prize laureate.

V.I. Spitsyn was born in Moscow on April 25, 1902. He graduated from MGU's school of physics and mathematics. His scientific work was connected with chemistry and technology of rare and radioactive elements, such as tungsten, molybdenum, tantalum, beryllium and technetium. Basic research which he did in this field is world-renowned.

A scientist with a wide range of specialties, V.I. Spitsyn made an invaluable contribution to the advancement of

D.I. Mendeleyev's theories in discovering new properties and states of transuranic elements from neptunium to mendelevium. V.I. Spitsyn made a substantial contribution to ensuring our country's defense capability.

Among his pupils are more than 100 candidates and doctors of sciences, who make up one of the largest Soviet scientific schools of inorganic chemistry and radiochemistry.

V.I. Spitsyn was awarded five orders of Lenin, the orders of the October Revolution and the Red Banner of Labor, and many medals of the USSR.

[The obituary is submitted by the presidium of the USSR Academy of Sciences; the Academy's Department of General and Technical Chemistry, Department of Physical Chemistry and Technology of Inorganic Materials, and Institute of Physical Chemistry; the USSR Ministry of Higher and Specialized Secondary Education; and Moscow State University imeni Lomonosov.]

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